THE IMPLEMENTATION OF A MANAGEMENT INFORMATION SYSTEM FOR A CONSTRUCTION SME: AN ANALYSIS OF DECISIONS AND THEIR IMPACT.

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Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the School Ethics Committee in 2007.

Name:

Signature:

Date:

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In memoriam: Elizabeth Douglas, Jenny Douglas, Cathy Nelson and Esther Hamilton.

Abstract

The aim of this research project was to study The implementation of a Management Information System (MIS) for a Construction Small/Medium Enterprise (SME) and analyse of decisions and their impacts. The main decision in the project meant that the SME did not actually adopt an MIS but rather a Document Management System (DMS), all of which is described and discussed throughout the study. The study covers many topics, such as Action Research, Social Construction Of Technology (SCOT), Technological Frames, other learnings from Research Projects in SMEs, MIS Definitions and Characteristics, Information Communications Technology (ICT) Adoption in SMEs, Methodology and Theoretical Frameworks.

The contributions to knowledge include understanding some of the industry's issues, the project's place in the studied business, knowing the researcher's place in the project, knowing the stakeholders and managing the project's output capabilities. These outputs have very practical applications and are listed as ten key lessons:

1. do not allow one staff member to wholly advise on the project;
2. do not isolate your staff from the project;
3. as a Construction SME, tendering is a way of life; use it to your advantage;
4. use as many knowledgeable people as possible to gather advice and evidence of similar projects;
5. use the SME networks professionally;
6. have a defined process of how your business operates day-to-day that everyone agrees to and follows;
7. as your company develops and grows, make note of the changes in how you work, who does it, and what the effects are;
8. consider the ultimate goal of the project and understand that ad-hoc changes can be devastating to the aim;
9. use the project to identify and cultivate the competences within the organisation;
10. add to the organisation's competences by utilising other peoples' backgrounds and experiences.

The theoretical contributions revolve around the method and methodology mixes. The project has clear areas of study; SMEs in the United Kingdom (UK), specifically in the construction industry, Information System (IS) adoption and the issues around Action Research type studies. Previously, academics, mostly from Management School or IS specialists, had built theories in order to explain the actions, interactions and non-actions taking place within their studies. However, by combining the Built Environment and Information Systems arenas from which the project had its roots, the researcher was able to offer two differing paradigms in order to find an alternative framework to explain the events that took place. This, added to by the use of Social Constructionism and the distinctive contextual drivers, created a project unique in its stance and approach to the problem. Vitally, this research provides academia with a study into Construction SMEs and their issues.

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Glossary of Terms

Pseudonyms used in Thesis	Brief description of duties
SMEcon	The Construction company forming the basis of the research
The researcher, AD	The author of this thesis
SMEsup1	Initial ICT support company
SMEsup2	Replacement ICT support company
DG	Professor David Greenwood, Lead Supervisor
DW	Professor David Wainwright, Supervisor
SMEnet	Intranet/Internet supply company
SMEnet contact 1	Initial contact from SMEnet
SMEnet contact 2	Replacement contact from SMEnet
HSE	Health, Safety and Environment
AD	The Researcher
NR	The Sponsoring Director/Commercial Director
SCOT	Social Construction of Technology
DMS	Document Management System
MIS	Management Information System
IT	Information Technology
ICT	Information Communication Technology
IS	Information System
ASAP	As soon as possible
HBM Ltd	Haden Building Management Limited
CV	Curriculum Vitae
3G	Third generation of wireless mobile telecommunications technology
OECD	Organisation for Economic Co-operation and Development

1 Introduction

1.1 Introduction

This chapter will provide the introduction to the study. It will list the problems discussed at the project outset, providing the background to why the study exists. For the interests of clarity throughout this document, the title ‘project’ will refer to work and activities happening within SMEcon, whereas ‘study’ is the broader academic focus of the Research.

1.2 The Problem

The research problem for the study was primarily based around one topic:

> *“The lack of business process information in the construction industry, making decisions on management system requirements, identification, design and adoption very difficult.”*

The problem is not isolated from other matters. Indeed, it is exacerbated by the current industry situation, where most research had previously focused on, and benefited, large construction enterprises. Many of these firms were independently developing complex distributed computer systems for co-ordination and management of project activities across diverse geographical locations with the aid of European Commission framework funding programmes. Some of these resulted in projects such as ‘Atlas’, ‘Condor’, ‘Osmos’ and ‘e-Cognos’ conducted between 1992 and 2004. These were complex software development programmes, developing reference ICT architectures for the construction industry together with prototype developments involving many consortium partners, principally end users, universities and large software houses. The project outputs enabled construction enterprises to act and collaborate effectively by utilising value-added internet-based flexible services to support collaborative working and teamwork in the context of the virtual enterprise (Ferneley et al, 2002; Wilson and Rezgui, 2002). However, much of this work has not been effectively disseminated or adapted down to the level of most construction sector SMEs, which makes up the vast majority of construction industry companies (Acar et al, 2005(; Brock, 2000).

In order to investigate these issues, a small construction company, SMEcon, was examined as part of an EPSRC-funded CASE project. SMEcon, as a private, commercial company had aims and objectives which they had to meet and any decisions and outcomes would form the basis of the academic study. Any alteration to the planned course, methods, timescale and eventual outcomes of the project would feed the outcomes of the study.

1.3 The Project at SMEcon.

In 2006, SMEcon was beginning to achieve success and had a number of staff in specialised positions within the organisation. They began working with DG and DW on a major project, starting with two workshops, from which the original terms of reference are shown below. This would form the basis of further work, including the Research project itself.

There is an opportunity to adopt a relatively 'greenfield' approach to develop simplified business processes, procedures, forms and documentation, towards the development of quality systems, best practice and, longer term, the appropriate selection of ICT applications and implementation within SMEcon. Best practice, both in terms of the context of business processes within the construction industry and also in terms of ICT systems management and delivery, will be identified for application within the business.

Figure 1.3a - Terms of Reference

The terms of reference then lead to an initial two phase plan, later extended to three phases, as shown below.

Three Phase Strategy
Phase 1: 'Process' - Completing the process mapping exercise and providing an interim report with recommendations: Target: 19th May (DW/DG)
Phase 2: 'Procedures' - identifying, analysing and streamlining the current SMEcon management procedures and information systems: Target 30th June (Daan Boll, Internship student/University of Twente/Northumbria)
Phase 3: 'ICT Support' - suggesting suitable ICT support for an integrated information management system that is compatible with SMEcon's needs and ways of working: Target: July 28th. (All)

Figure 1.3b - Three Phase Strategy, (Greenwood & Wainwright, 2006, p2)

These sections of the report show the overall plan for work between SMEcon, DG and DW, as set in May 2006.

In response to the need for more simple and standardised systems, a 'top down' process model has been developed by the research team and validated by SMEcon personnel.
The agreed process model should form the basis of responsibilities, processes and procedures (with associated standard documentation) within the company;
These elements (responsibilities, processes, procedures and documents) should be mapped against the high level model as a basis for their classification;
In classifying these elements against the model the twin objectives of simplification and standardisation should be paramount;
The resulting system should be captured in a loose-leaf (thus editable) systems manual;
The systems manual should be disseminated within the business in a short seminar / workshop.
Files/documents are being reviewed by the research team for their necessity / contribution / added value to the business and legal requirements.
SMEcon management to validate the results and any necessary amendments to be made (as a result of validation);
Documents in the new system to be re-named (using more logical classification names – to be agreed) and in exceptional cases redesigned;

The new document system to be implemented and monitored on a new project with a view to its adoption as SMEcon's standard paper-based procedure;
The new document system to be disseminated (through briefings) right across the SMEcon team.

Figure 1.3c - Phase 1 - Recommendations, (Greenwood & Wainwright, 2006, p18)

Phase one, the Process phase, had the recommendations shown above. It lists the actions already taken, regarding responsibilities, processes and procedures, before recommending the completion of various validation exercises and finally, a physical description of how the document system should look and work.

Phase two was completed by a visiting Northumbria University student from The Netherlands, Daan Bol (DB). His remit is shown below.

The project focuses on the processes and procedures at SMEcon. The goal is to make recommendations on time and cost efficiency. The first step is to map the processes of all key elements of SMEcon. Because there is a large variety and the time-span is only three months, it is not possible to map them all. Therefore the focus lies on the key element Develop.
Mapping out these processes will be done by means of workshops and interviews. The results are the input for a specific business model. The model will be an overview of all processes and activities.
The second step is to review all the documents/files employees of SMEcon use in the Develop-element.
The third and last step is cross-referencing the first with the second step. The documents/files are reviewed for added value to the business and legal requirements. The 'willmaybin' system will be used for review; will have, may have and bin.

Figure 1.3d - Phase 2: Project Framework, (Bol, 2006, p5)

This phase was very time-constrained due to DB only working for three months in Newcastle, away from his home institution, University of Twente. His work was planned to revolve around the Develop section of the company structure and identify the necessary processes, procedures and documentation required for this part of the company.

1.4 The Study of the SMEcon Project

This project identified requirements to review the previously mentioned innovations and utilise the core concepts, ideas and architectures within a live, small business environment utilising low cost and readily available packaged software solutions, such as Microsoft SharePoint Portal or similar collaborative groupware technologies.

By applying co-operative inquiry and participatory action research-type methodology, the utilisation of prototyping as an iterative development approach for the design, development, adoption and diffusion of the collaborative groupware system was initially planned. State of the art business process and enterprise modelling software was to be used to develop the SMEcon specific and industry standard models. These models and prototype collaborative

system would be developed under supervision at the research team with piloting and roll out within the live industrial environment. The specific activities were listed as:

- Conduct full scale ‘as is’ and ‘to be’ business process modelling for SMEcon;
- Identify Construction industry standard processes and procedures, adapt within SME context;
- Evaluate state of the art collaborative groupware technologies for fit within construction SME and SMEcon context;
- Acquire, design, develop and implement suitable integrated construction management information system;
- Iteratively adapt and refine system to provide capability for organisational learning;
- Develop integrative framework for ICT development, adoption and diffusion in the construction SME sector;
- Disseminate good practice and findings. This will be done within the North East with the assistance of organisations such as Constructing Excellence and nationally and internationally through academic and practitioner-orientated events and academic publications.

The expected outcomes from the project and study were:

- Phased delivery of a prototype, pilot system and full operational ICMIS for SMEcon practical operations and also Northumbria University as a research simulation.
- Research with significant contribution to theory relating to the development of reference business process models and participative development methods for groupware collaborative systems in the construction domain.
- Significant financial benefits for SMEcon in terms of efficiency gains from enhanced ICT systems capability, new marketing opportunities and development of competencies through organisational learning.
- International publications for the research team to disseminate key findings to both academic and industry practitioner audiences and contribution to the RAE.
- Contribution to the North East regional economy through the parallel dissemination of good practice relating to business process management and ICT adoption within the construction and SME sector (through workshops, seminars, university teaching, short courses and sector specific publication).
- Development of strong collaborative inter-disciplinary research interaction between university Schools of Built Environment and Computing, Engineering and Information Sciences and the Construction industry sector.

1.5 Original Aims and Objectives

The original aim of this research project and study was to model the creation of a Management Information System for Construction SMEs with a view to implementing ICT solutions. In order to accomplish this, a number of objectives were identified as integral to the project:

- A review of current SME business process models in both the construction and other industries.
- The formulation of a model that outlines business processes in Construction SMEs.
- To test the derived processes in the workplace.
- Creating significant financial benefits in terms of efficiency gains from enhanced ICT systems capability for SMEcon.
- New marketing opportunities for SMEcon.
- Development of competencies through organisational learning for SMEcon.

However, the SMEcon project developed a new pathway with many key decisions by one particular SMEcon employee completely changing the direction when compared to initial thoughts. As highlighted in Chapter 3 - Methodology, this was meant to be an Action Research project, with both the researcher and the organization learning about various issues as the project progressed. Indeed, the project did follow the form of an Analytic Auto ethnography as it met the five key features as described by Anderson (2006). Also, and more importantly to SMEcon, they ended the process with the system they procured, working exactly to their specification. The project's alternative pathway has had a large effect on this thesis. The researcher has still been able to publish the anonymised details with the aim to gaining a Research qualification, as well as presenting at various conferences in both the Construction and IS research fields. However, with the project deviating from its intended course, it has also contributed some other unplanned insights to the field of study.

1.6 Revised Aims and Objectives

As mentioned earlier, the research problem for the study was primarily based around one topic:

> *"The lack of business process information in the construction industry, making decisions on management system requirements, identification, design and adoption very difficult."*

This proved to be the case at the earliest opportunity both the project and study's timeline. The study began at the end of September 2006 however the researcher did not begin the project element until January 2007, thus beginning four months late, as the SMEcon did not have the resources available in order to collaborate due to other work commitments.

The project also lacked some major constituents that, based upon the previous documented work undertaken, should have existed and been applied:

1. No standard operational documented processes or work forms.

2. No independent technical/management/project advice.
3. No project consultation on the ICT solution to be used, although some limited advice given.

These elements were necessary to form an operational basis that the project could then build upon. Added to the above mentioned points was SMEcon's decision not to apply a tendering process when they went to market to purchase an ICT solution. The individual responsible for this and other decisions is discussed from Chapter 6 onwards.

The full story of how these missing elements directly affected the working of the project are captured in detail through the researcher's diary entries, a sanitised and abridged version of which are captured in Chapter Five. Two key project outcomes were produced due to these missing elements and processes:

1. SMEcon did not adopt an MIS.
2. SMEcon did adopt a DMS.

This radically altered the aims and objective for both the project and the study. The project's objectives were altered:

- To design and adopt a paper-based standard form library that is based upon desired working processes within SMEcon.
- To apply this model to a newly purchased DMS, including configuration of the DMS's workflow system.
- Adoption, user training and rollout of the DMS across SMEcon.

The overall aim was for SMEcon to have an operational DMS across all users that would create an efficient, standardised workflow model to manage their document processes. This statement was never explicitly made during the project. The aim of the study has also changed completely.

The study will analyse what happened in the SMEcon project with a view to answering why it occurred and what this could mean to wider SME communities. The objectives to meet this aim are:

1. Review of the adoption of a new paper-based form library within a small company and its effects on the business.
2. A review of the overall DMS adoption project and the decisions that lead to it.
3. Extrapolate learnings from review evaluation interviews
4. A comparison of this project's process with other documented studies

1.7 The Contributions to Knowledge

In order to identify the contributions to knowledge of this thesis, the researcher must remove the specific practical issues from the case and highlight the overarching themes that can be

drawn. However, the very project itself is a contribution to knowledge. This is primarily due to the fact it exists; there are very no similar Construction SME examples of adopting a DMS in this manner within academia. There are two identifiable areas that can be aligned to the main aims of the project; IS adoption in Construction SMEs and AR techniques in SMEs.

1.7.1 IS Adoption techniques in Construction SMEs

The practical contribution involves the lessons learned from the actual adoption of an Information System, in this case a DMS, into a small construction company.

1.7.1.1 The Construction Industry

The construction industry is fragmented, with silos of information, knowledge and processes given added validity by professional organisations such as the Royal Institute of Chartered Surveyors (RICS) and the Royal Institute of British Architects (RIBA), to name two. These bodies promote their importance to the construction industry and their members. However, these professions do not represent the vast majority of construction workers i.e. site-based workers, such as bricklayers, joiners, plasterers, electricians, etc. Many of these workers are self-employed or work for SMEs, which are sub-contractors with little individual power or influence. Many of the suppliers are not represented either, apart maybe from the Architects. Indeed, construction management, where these bodies are mostly represented,

> *"deals with the ideal, building the structures on paper. The workmen in the field are absorbed with the messy process of getting the work done, of making mistakes, of fighting bottle- necks and bad weather, of having to bare their emotions and tempers, as well as using politics and exchanging favours to accomplish their tasks. The engineers' and managers' view of the project is very fuzzy, based on their limited, idealistic notion of what is supposed to happen according to procedures and paperwork. The actual behaviour does not at all correspond to management's view and can only be understood by examining the activity of workmen in the bowels of the building, in the meetings between the men and their foremen, in the conversations between superintendents and the craftsmen"*
>
> (Applebaum, 1982, pp 225)

These behaviours may not be restricted to the construction industry only. Indeed, wherever there are professional organisations, there are silos of knowledge and processes pertaining to that organisation's members.

This all has a huge effect on the industry's competences. If the industry remains in silos, and is non-inclusive of all the stakeholders necessary to have an industry, how can it grow and mature into a holistic entity? This has been noted with the introduction of a new technology, BIM. Although most recognise that it is a worthy development, as seen by the proliferation of education establishments suddenly promoting their expertise on the topic, the industry is not

quite as quick on its uptake. Obviously, new skill-sets need to be identified and trained out, but it may be that the design of a building now includes all the material planning problem solving done by specific workers. The researcher has identified two stakeholder groups affected by this technology; professionally supported Surveyors and non- professionally supported site-based workers. The researcher posits that the technology advances in BIM are not welcome due to the potential negative effects on jobs and roles. This cynicism towards the effects of technology is a significant factor in the lack of IS adoption within the Construction Industry.

Most stakeholders, including those in SMEcon, acknowledge the necessity of technology in the workplace, but not any more advanced that aiding communications and storing information in their own manner. NR himself did not feel that SMEcon needed an IS system and with his previous work experience within construction, it is not too much to suggest that this view is generally indicative throughout the industry. These issues must be addressed if the construction industry is to mature, or IS adoption will not be an expedited process.

1.7.1.2 Understand the project's place in the business

In any organisation, many issues are being dealt with. In large firms, there are departments responsible for specific business areas, such as Human Resources, Payroll, Purchasing, etc. the list goes on. SMEs tend not to have these specific departments, as the resource issues are too costly and not really necessary for the volume of tasks being undertaken. However, and SME that is growing must pass a transition, where the idea that everyone can do most things has to change. A structure begins to form, and suddenly, people are responsible for specific tasks. SMEcon had just done this; they had a buyer, an estimator, surveyor, finance people, etc. depending upon the IS being adopted, it will affect these departments in differing manners. If it is a financial system, it is reasonable to posit that Finance will be involved heavily, but that Design may not. In an newly structured SME, this is more complicated as the staff still have recent memories of unstructured operating, causing some negativity towards a project that they feel they should be involved in, but are not. These organisational behaviour issues can affect the progress, and even success of a project. SMEcon's approach was to keep the project away from everyone, except the sponsoring director. This caused many issues;

1. Incorrect identification of the main stakeholders
2. A lack of input from the key stakeholders
3. A lack of input from experienced employees now working in areas not directly affected

These factors contribute to a lack of understanding where the project sits within an organisation. It also negatively affects project governance, as the stakeholders that will ultimately utilise the IS system, have not had any input into the business requirements of the system, and its operation. All of these factors need to be mitigated in order for the correct stakeholders to have the appropriate level of input, thus governance, for the adoption, as well as giving the project a defined location within the overall organisation's operation.

1.7.1.3 Know your (the researcher's) place

As an action research type project, the researcher is at the very centre of the work. This is very different from Mode 1 styles of research and investigation, where the researcher and the team have defined the problems, and all are very well qualified within a narrow band of competences. AR cannot operate in that manner. Context is vital. Questions such as 'where did the problem first appear? and what is the problem? need to be asked. This could, through the many different and unexpected issues that may arise from these questions, require a broader, transdisciplinary knowledge base to investigate. In this project, the researcher's own context was seen as a benefit to the project, as well as the research team's contexts and knowledge. It is important that such a team is available at periods through AR in organisations.

1.7.1.4 Know your stakeholders.

Stakeholders are critical in any project, whether it be research or new product development; without people, there is no project. However, stakeholder identification and classification is not a simple process. One lesson from this project is, just because the person sponsoring the research says that something is right, it does not necessarily mean that this is true. Opinions are formed by everyone and these may not reflect the way things are. There are many pitfall that the researcher fell into during the AR process in SMEcon, and stakeholder classification was one that was not investigated until much too late in the project's life. In this case, this was not totally the fault of the researcher, but rather the conditions placed upon him at the beginning of the project. These should have been more robustly questioned, but were not.

1.7.1.5 Manage the project's output capabilities.

Industry and academia work at differing paces. Companies must work to at least keep up with customer demand, and if possible, lead customers into other, profitable areas. Academia requires thinking time. This may be a quick process for the individual researcher but, due to the vagaries of the more bureaucratic academic arena, this may not transpire at

quite the speed wished for. There are many good reasons for this enhanced rigour including peer review and reflection of points not considered. In this project, some delays were caused by personal factors that can affect any person in any walk of life.

The main learning from this is to keep focused upon what was asked initially. There may be developments along the way e.g. not adopting and MIS, but the researcher must be able to produce an output that can tell the story in a rigorous and structured manner. AR also has the practical output of doing the project that the organisation wished for. By keeping these in mind, the outputs will provide a coherence from which the project can be measured.

1.7.2 AR techniques in SMEs

Action research in SMEs requires an approach that appears to be inherently different to those discussed in larger organisations. The researcher becomes the hub of the project, just as per larger firms, but as this is a resource-limited SME, they also become central to stakeholders that are running the whole organisation. That is not to say the researcher is 'controlling' the company, but they are now receiving and disseminating information from the whole organisation.

This could give great power to the researcher who, if not careful, could seriously undermine or disrupt the very organisation in which the project is placed. In larger firms, the effect would be less obvious, as there would be several layers of management involvement. This potential could be turned to the benefit of the organisation too, if the researcher had that type of experience and knowledge with which to influence. None of this must happen. The researcher must focus solely on the project on hand and take themselves out of the business mêlée by grounding themselves into the academic side as often as possible; otherwise the phrase 'going native' may be labelled towards the researcher.

Another technique for the researcher in these projects is to avoid mentioning the fact you are an academic. Company employees, and other employed stakeholders, do not wholly feel comfortable with this notion, which may be a UK specific cultural phenomenon. This may be one reason that NR did not introduce the researcher to the SMEcon employees sooner.

The final technique gleaned from this project is that the researcher must not be afraid to utilise their own contextual learning so far, whether they are academic or work sourced. Issues, people, projects and problems do not come without history, and this must be at least acknowledged, if not fully explored. Utilising bricolage and other research methods will aid the success of a project, and prevent it from being a never-ending AR project.

1.7.3 Method and Methodology

This project has two clear areas of study; Small and Medium Enterprises (SME) in the United Kingdom (UK), specifically in the construction industry, and Information Systems (IS) adoption, specifically a DMS. Within these fields, academics, mostly Management School or IS specialists, have built theories in order to explain the actions, interactions and non-actions taking place within their studies. By combining these two areas, the researcher looked to both 'camps' in order to find a suitable framework that can explain the events that took place. This collision of two differing paradigms provides a real knowledge contribution.

The key to this was the researcher's stance; Social Constructionism. The built environment is often planted from a Positivist approach, where there is a predetermined knowledge of both the problem to be rectified and the process about to be undertaken necessary before any project begins. This project did not begin in this manner. This is where the researcher and their context was vital. The researcher argues that no project can be seen wholly independent of its environment or history; this is the same for the researcher tasked with studying. These two histories must influence each other, providing a project path that cannot be known before it has begun. Also, the language of the histories must connect and this was certainly the case with this researcher and the project. If these were not important, why would the researcher need to provide Curriculum Vitae information other than that of their academic grades and suitability before being accepted into the research team?

Once the project commenced, the researcher then had to structure the research in such a manner that the full journey of SMEcon could be represented clearly. This research framework was finally settled upon with the application and adoption of SCOT and Technological Frames. From this, the researcher was able to devise a validation tool to measure the thoughts and reactions of the SMEcon employees, in order to balance out any potential bias towards the project's success, or otherwise.

This innovative approach is enhanced by the researcher's use of AR and Bricolage. Although the initial planned use of participative AR did not occur, the researcher's ability to adapt to a more historical, dialogue-based AR as described by Masters (1995) proved to be an excellent fit to meet both the project's and study's requirements. By utilising all of the 'tools' from his own history and experience, as well as those of the research team, the researcher is able to fashion a cohesive, rigorous and validated study that has the depth of a traditional Action Research type project aligned to repeatability brought by the benefits of SCOT and the focus of Technological Frames.

1.7.4 IS adoption in SMEs

This project did not adopt an MIS but rather a DMS. The ten key lessons learned during the study are:

1. Do not allow one staff member to wholly advise on the project; it must be a representative spread of staff members/stakeholders to represent the whole organisation.
2. Do not isolate your staff from the project. Their assistance will mitigate against resistance to and changes.
3. As a Construction SME, tendering is a way of life; use it to your advantage.
4. Use as many knowledgeable people as possible to gather advice and evidence of similar projects.
5. Use the SME networks professionally, not just who you know directly or through friends.
6. Have a defined process of how your business operates day-to-day that everyone agrees to and follows.
7. As your company develops and grows, make note of the changes in how you work, who does it, and what the effects are.
8. Consider the ultimate goal of the project and understand that ad-hoc changes can be devastating to the aim.
9. Use the project to identify and cultivate the competences within the organisation.
10. Add to the organisation's existing competences by utilising other peoples' backgrounds and experiences.

These are very practical and not specific to IS projects. They are vital to understanding why academic theories may not be viewed as useful in the field. Theories should be built upon observation, logic, reason, rigour and repeatability. This study shows that decisions made in industry are not always logical, reasoned, rigorous or repeatable. Indeed, even the context and history prove to be no predictors in decision-making behaviour. This must pose other questions when looking at SME organisational behaviour, which was not part of this project's remit.

1.7.5 IS in Construction SMEs

The research provides some key general points for any Construction SMEs with a view to implementing information system solutions, nine of which are listed in the section above. However, one vital lesson from a construction company stance is that tendering is a way of life; use it to your advantage. SMEcon trapped themselves by failing to act on something that they are required to do as part of their standard 'modus operandi'. Due to the rare nature of specific SME studies, it is difficult to state with all authority that this kind of illogical behaviour is widespread amongst other construction SMEs.

Another contribution to knowledge involves the speed of uptake of the project. This study started in 2006, but it was early 2007 before the researcher was able to work with the company. This delay was unfortunate, but did lead the researcher to question whether SMEs can adapt quickly to change, as is often described in the literature. Indeed, SMEcon knew this project was going ahead late in the summer of 2006, before the researcher himself signed up to read for a Research. This, allied to the time that was taken to create the paper-based system, again initiated before this project began, showed signs of inflexibility on behalf of the organisation. When the whole project is taken into consideration, three years to adopt a DMS within the company is an incredible amount of time for something described by most as so important to the operation of the company. Further research regarding resource allocation decisions and the nature of Construction SMEs may shine some light onto this phenomenon.

1.7.6 Additional example of ICT/IS adoption in SMEs

This thesis is the output of a rare project studying an ICT adoption within a small construction company. Although there are other SME, ICT adoption projects, such as the WestFocus report heavily mentioned in Chapter 2, they tend to be across industry sectors that do not represent the construction industry. This is astonishing considering the amount of SMEs operating within the construction industry and the size of the industry itself. As a huge contributor to the UK GDP, the amount of SMEs is vast and surely a consideration for further study.

2 History

2.1 Introduction

The following chapter will give an account on the history and current writings of MIS Adoption in Construction Small and Medium-sized Enterprises (SMEs). Initially, it will provide some definitions of SMEs and the Adoption of MIS. This will be generically applicable to SMEs in the construction industry and beyond. Thereafter, publications on the topic MIS Adoption in Construction SMEs as a whole will be examined. Finally, the area of study will be summarised.

2.2 MIS and DMS Definitions and Characteristics

Management Information Systems (MIS), Information Systems (IS), Information and Communication Technology (ICT), Document Management Systems (DMS), Information Technology (IT) along with a plethora of other names and acronyms, all have their own definitions. However, the differences between them are rarely noted when discussing them 'out in the field'. Indeed, Checkland and Howell (1999, p 91) "criticise current IS literature for not being able to give a clear and coherent account of the field. Even the most basic concepts such as, data, information and knowledge lack agreed upon definitions."

Davis (1982, p 10), used the term MIS as it had first been discussed in 1967, saying that "it reflected a broad view of the scope of information systems in organizations. Terms such as data processing seemed too narrow. People using the term MIS in those days were saying that information is an organizational resource and should be managed as a resource. Also, information systems should support management processes by providing useful, useable information." Mason and Mitroff (1973, p 475) stated that "an information system consists of at least one person of a certain psychological type who faces a problem within some organizational context for which he needs evidence to arrive at a solution (i.e., to select some course of action) and that the evidence is made available to him through some mode of presentation. This defines the key variables that comprise an MIS." These MIS definitions have the elements that UKAIS (2009), the UK Association for Information Systems, use for defining IS. "Information systems are the means by which people and organisations, utilising technologies, gather, process, store, use and disseminate information." Another encompassing definition is given online at www.businessdictionary.com. It states that MIS is an "organized approach to the study of information needs of a management at every level in making operational, tactical, and strategic decisions. Its objective is to design and implement man-machine procedures, processes, and routines that provide suitably detailed reports in

an accurate, consistent, and timely manner. Modern, computerized systems continuously gather relevant data, both from inside and outside the organization. This data is then processed, integrated, and stored in a centralized database (or data warehouse) where it is constantly updated and made available to all who have the authority to access it, in a form that suits their purpose." (*www.businessdictionary.com*, 2009)

According to Stair et al. (2008, p10), an Information System (IS) is a

> *"set of interrelated elements or components that collect (input), manipulate (process), store, and disseminate (output) data and information, and provide a corrective reaction (feedback mechanism) to meet an objective."*

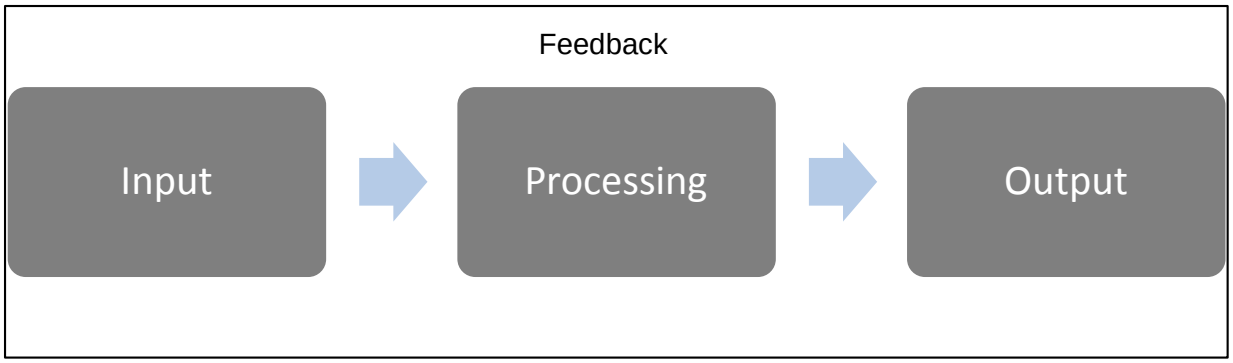

Figure 2.2a - The Components of an Information System

This description is a very mechanistic, linear representation of what an IS could be. Things are very rarely as simplified as this and the 'real world' seems to have difficulty in deciding what an IS is, or even that it is distinct.

As for ICT and IT, similar definition difficulties appear. The most complete definition of ICT and IT is from the OECD (2008, pp 11 & 17), who split it into two distinct classes; firstly products, then content and media. "ICT products must primarily be intended to fulfil or enable the function of information processing and communication by electronic means, including transmission and display....Content corresponds to an organised message intended for human beings published in mass communication media and related media activities. The value of such a product to the consumer does not lie in its tangible qualities but in its information, educational, cultural or entertainment content."

Document Management Systems (DMS) follow a similar pattern of definition, with different organisations and academics providing their own emphasis. There is a lack of research where the term DMS is directly used, however, Electronic Document Management, EDM is a valid term to describe the solution presented during the project.

The three words making the term EDM are described thus:

- *Electronic: the use of modern information technologies.*
- *Document: a set of information pertaining to a topic, structured for human comprehension, represented by a variety of symbols, stored and handled as a unit.*
- *Management: creation, storage, organization, transmission, retrieval, manipulation, update, and eventual disposition of documents to fulfil an organizational purpose.*

Sprague, Jr. (1995)

Sprague (1995) argues that there must be a business value derived from the documents held electronically and that their management can generate business in two ways: As a revenue generating product, e.g. publishers, or a management information resource.

As SMEcon are a construction company, and not a publishing house or some other document type service, the business value that the DMS created is in the second form, which itself has three distinct categories:

1. *Improved management and communication of concepts and ideas.*

   A major value of EDM derives from its ability to expand the scope of information management from facts in the form of data records and databases, to concepts and ideas that are generally captured, stored, and communicated in the form of documents. EDM technology can thus improve the efficiency and effectiveness of documents in their role as a primary mechanism for storing and communicating concepts and ideas within and between organizations (and their groups and individuals). This set of benefits directly supports the expected structure of future organizations that are likely to be flatter, heavily based on teams, geographically distributed, and more dependent on their ability to handle rich and varied information.

2. *Upgraded, "reengineered" basic business processes.*

   Most organizations have a substantial set of "paperwork" systems that have been resistant to computerization, at least partly because they are based on documents rather than (or in addition to) data records. Evolving EDM technologies will support more of these applications. Real benefit will result, not just from automating these processes, but from rethinking or reengineering them to take advantage of the advanced technology (Kind and Eppendahl, 1992).

3. *Leveraging Organizational Memory.*

   Documents form an important part of organizational memory, and EDM can improve the ability of the organization to utilize it. In the short run, major value derives from merely storing paper documents in electronic form. In the long run, EDM will provide the means to access and analyze organizational memory to improve productivity and performance.

Sprague, Jr. (1995), pp 31-33

All of these definitions have elements of similarity, and it is little wonder that academic authors and practitioners use the terms interchangeably. One term used in the definitions is technology. People's views on 'what is technology' are varied and potentially, controversial.

From a UK Governmental taxation view, technology is "the practical application of scientific principles and knowledge, where science is the systematic study of the nature and behaviour of the physical and material universe. Work in the arts, humanities and social sciences, including economics, is not science for the purpose of these Guidelines. Mathematical techniques are frequently used in science, but mathematical advances in and of themselves are not science unless they are advances in representing the nature and behaviour of the physical and material universe." (DTi, 2004) The Merriam-Webster Online Dictionary offers these definitions of technology. It can be "the practical application of knowledge especially in a particular area" or "a capability given by the practical application of knowledge" as well as "a manner of accomplishing a task especially using technical processes, methods, or knowledge" (Merriam-Webster, 2009). These are very 'knowledge' oriented definitions but what about people's perceptions of technology.

It is argued that "in a simple and obvious way, technology is indeed a set of tools we apply to the environment – natural and human – to accomplish our goals." (Lairson, 2003) However, Lairson goes on to state that this is too limited and need to involve the overall environment. "It ignores the profound consequences for creating and redistributing resources in society. Technology helps to define values and goals, primarily by turning abstract possibilities into real options. The idea of operating a business quickly and effectively across an entire continent was just an empty dream in 1820, but by 1900 the railroad, steamship, and telegraph had made this a practical reality. The consequence of this change was a revolution in the way business was conceived and managed. Even more profoundly, technological change can alter the very structure of society through a complex set of effects on power relations within and between societies" (Lairson, 2003)

This idea of technology as a tool that affects many other facets has appeared in other writings. The New Scientist published an article in January 2009, discussing monkeys 'using tools'.

> *"They say a bad worker blames his tools - but it's hard to imagine a capuchin monkey using such an excuse. The crafty little monkeys of Boa Vista in Brazil are often seen using heavy rocks to crack open large palm nuts. Now, researchers say they are experts at choosing the best stones for the job. In field experiments, Elisabetta Visalberghi of the Institute of Cognitive Sciences and Technologies in Rome, Italy, and colleagues have shown that the capuchins actually test their stone hammers before use. If a monkey thinks one stone might not be up for the job of cracking the sturdy nuts - say, because it is too light or too likely to crumble - it will not waste time*

> *with it. Instead, the capuchin will move on and find another stone more suitable for the job.*
>
> *"This shows it is not just apes and hominines that can select a tool using sophisticated methods," says Visalberghi. "Humans learn by trial and error and it's very likely that non-human primates share this with us." Researchers are keen to know more about how and why wild animals use tools because they hope it can shed light on how human technology evolved. One of the most famous examples of animals using tools was discovered in 2007 when a group announced it had filmed chimpanzees using spears to hunt bush-babies in Senegal. Crows are also known to use sticks to "fish" for insects and even to use one tool to get hold of another to reach their food."*
>
> (Brahic, 2009)

The article suggests that other, non-human species use tools to do something that they cannot manage without them. This, based upon the definitions above, implies the adoption of technology and provides a much wider definition of technology.

The definition by Paul (2007, p194-5) states that IS "is what emerges from the usage that is made of the IT delivery system by the users", and that this can be shown to be in two distinct elements:

> *"First the formal processes, which are currently usually assumed to be pre-determinable with respect to the decisions about what IT to use. However, these processes will then need to change quite quickly in two ways: first whenever the system is found not to work as anticipated and second so that the IS can appropriately be adapted to the changing world around it, in particular its host organisation. This adaptation can be easily seen to be necessary when one considers that an IS is a model (at some level of abstraction and approximation) of the business. If the model does not keep up with changes in the business, then its value rapidly becomes more historical.*
>
> *Second the informal processes, which are what the human beings who use the IT and the formal processes create or invent in order to ensure that useful work is done."*
>
> Paul (2007, p194-5)

He goes on to comment that IS creation is continuous due to the users and their formal and informal working processes. This implies that if the IT is changed, for example, upgraded to a newer model, the users will adapt their working practices to suit, thus making a new IS. Three main points were identified for this definition (Paul, 2007, p 195):

- The IS is not the IT and the formal processes being used.
- The IS is not the people using the IT and the formal and informal processes.
- The IS is what emerges from the usage and adaptation of the IT and the formal and informal processes by all of its users.

In summary, the adoption of technology depends upon how individuals perceive and use it, which has implications on how IT, ICT, IS and MIS are viewed and subsequently, interacted with. Chapter 4, Theoretical Underpinning, discusses these perceptions and the origins through the use of the Social Construction of Technology.

2.3 SME Definitions and Characteristics

The UK definition of SMEs runs along similar lines to the University of Strathclyde's extrapolation of the pertinent UK Government department designations. They "show that out of 4.7 million businesses in the UK, 99.3% were small firms with fewer than 50 employees, and 0.6% were medium firms with 50-249 employees.... In the UK, sections 382 and 465 of the Companies Act 2006 define a SME for the purpose of accounting requirements. According to this, a small company is one that has a turnover of not more than £6.5 million, a balance sheet total of not more than £3.26 million and not more than 50 employees. A medium-sized company has a turnover of not more than £25.9 million, a balance sheet total of not more than £12.9 million and not more than 250 employees." (University of Strathclyde Library, 2009)

The current classification of an SME from the European Commission states that "the category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding €50 million, and/or an annual balance sheet total not exceeding €43 million." (European Commission, 2009) They go on to give some interesting statistics regarding the importance of SMEs as "they represent 99 % of all enterprises in the EU. Some 23 million SMEs provide around 75 million jobs."

However, despite governments and many of the multinational organisations targeting this group for special financial business support, there is no single definition for a SME either nationally or internationally. It is worth noting that even within the UK this definition is not universally applied.

2.3.1 Organisation

ICT adoption, as mentioned earlier, is limited both in researched accounts and the actual results from the little research that has been done. The very make-up of SMEs may be the main factor in this. Firstly, it is argued by Acar et al and Levy, Powell and Yetton (2001) that the size of the firm is important. Acar et al (2006, p715) asked four questions regarding this notion.

1. Is there a significant difference between SMEs of different sizes regarding the perception of the influence of ICTs on business performance?
2. Is there a significant difference between SMEs of different sizes in terms of their ICT investment attitudes?
3. Is there a significant difference between SMEs of different sizes in terms of the level of usage of ICTs?
4. Is there a significant difference between the software preferences of SMEs of different sizes?

These questions were aimed at the top decision makers of general building contractors in Turkey, some 75% of whom were owner-managers. Acar goes on to provide a practical implication of his study, specifically for those who "develop technology diffusion policies and implementation tools in the building construction industry...The findings may be useful in understanding the relationship between organisational size and ICT related attitudes of SMEs active in building construction."(Acar *et al.*, 2006, p 720) He states that SMEs are "not a homogeneous set of firms with identical characteristics; rather, SMEs consist of clusters of firms with varying characteristics" (p720) and that policy makers should be aware and act upon this diversity. Acar then points out that as "smaller contractors are unaware of the potential benefits of ICTs as evidenced by the findings, policy makers might use new initiatives to overcome this problem such as exploring the adaptability of technology diffusion tools developed for SMEs in manufacturing industries (e.g. see OECD, 1995)." (Acar *et al.*, 2006, p 720)

These findings are supported by work discussing reasons for SMEs deciding on why they need IT. Levy et al. (2001) discusses the reasons that the introduction if IS into SMEs "has tended to be fragmented and based around operational support and transaction processing..." and that "the interest and enthusiasm of owners drive IS adoption." (Levy, Powell & Yetton, 2001, p 134). They go on to point out that adoption is often not strategically planned and "while some SMEs are developing web sites, few have them linked to their transaction processing systems"(p 134) making any competitive advantage be more by luck than guidance. Added to this is the fragmented nature of procurement, where SMEs invest incrementally, and causing major problems in the effectiveness of the system's overall use.

The firms that do manage to build for growth are often more mature SMEs, where a formalisation of systems is required. However, most still fail to plan the adoption of the systems, thereby losing any advantage that it may have brought due to the need to convince all stakeholders that it is better than what they had before. Other limiting factors of IS adoption successes are:

- Insufficient time spent by management on future business developments,

- Limited experience, skill or interest of management teams in order to exploit technology,
- The age and experience of the owner,
- A lack of trust of external IS sources, as SMEs do not have in-house IS skills,
- Limited financial resources.

These inhibitors, as discussed by Levy et al (2001), cause IS adoption in SMEs to give few, if any, performance benefits. “Indeed, firms with more sophisticated IS tend to perform worse than those with more limited systems. This is primarily due to SMEs’ limited IS knowledge and skills, thereby precluding them from taking advantage of the strategic information available from the more sophisticated systems in which they have invested.”(Levy, Powell & Yetton, 2001, p 134) They then state that IS adoption seems to be successful in only two main forms:

1. It is a low-cost investment for providing efficiency savings, where IS is not central to business and the owners’ experience of IS is limited. This leads to IS being focused on transaction processing systems.
2. It enables a value added strategy, driven by necessity or due to innovative owners who are looking for business growth. The IS investment is likely to be much more innovative with a greater emphasis on management information.

For an SME growth strategy, Street and Meister (2004) give a list of items that must be adhered to for success, including changes the overall management structure, operational planning, control and communication practices of the firm. “Failure to make these changes may result in harm to the business through stagnation, negative growth, loss of customers, and failure to introduce new products, potentially closing the business” (Street & Meister, 2004, p 474)

2.3.2 Strategy

SMEs tend to be followers when adopting MIS. While the SME sector is lauded for its flexible response to customers, there is little evidence of flexibility in its management IS. Replacement of management IS often occurs as a response to a crisis rather than a recognition that the business has outgrown the system’s ability to deliver. Most SMEs focus on survival rather than competitive advantage, which limits the agility of response to investment in IS. This is due primarily to limited resources, particularly finance, as well as nervousness about whether the purchased system will satisfy business requirements. Since most SME IS development is outsourced, there also are concerns about adequate technical support. These problems may lead SMEs to work with small IS suppliers with the concomitant risks. (Powell & Levy, 2006, p i)

The actual strategic planning of IS has long been known to be essential for large firms. It is also beneficial to growing SMEs, particularly due to increasing complexity of system requirements as the firm grows. Successful IS adoption is more likely if SMEs already have an explicit strategy (Levy & Powell, 2000). IS strategy (ISS) is a dynamic activity carried out as part of the business strategy review. ISS provides the means to analyse management information requirements for firms in order to measure business success. The problem for many SMEs is that business strategy often is implicit and emergent. (Levy, Powell & Galliers, 1999)

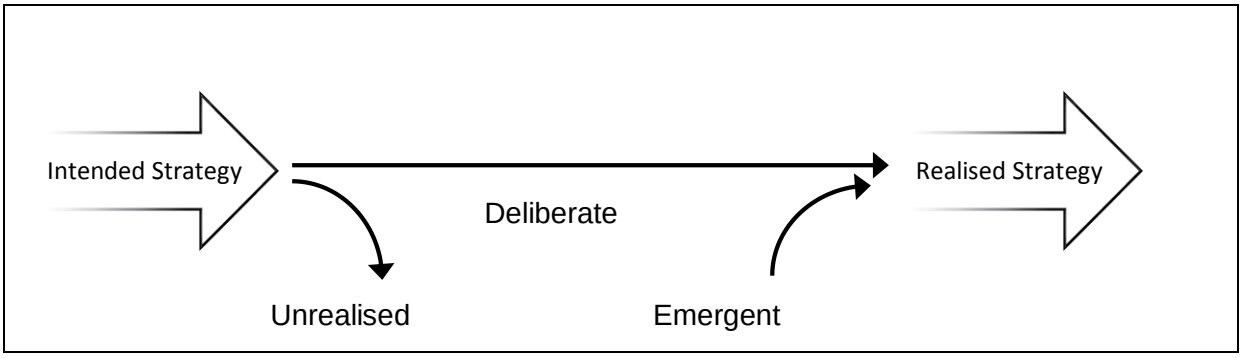

Figure 2.3.2a - Types of Strategies (Mintzberg & Waters, 2006, p 258)

The notion of emergent strategy is discussed at length by Mintzberg, amongst others, and figure 2 shows some of the strategy types he identified. He states that for a strategy to be completely deliberate i.e. for something to happen as intended without fail, at least three conditions would have to be met:,

1. Precise intentions, articulated exactly to allow no doubt of meaning, must have existed within the organisation before any activity took place.
2. These precise intentions must have been common to virtually all the actors involved. This could be through their own shared intentions, or those accepted by leader who had control over the actors.
3. These precise, collective intentions must have been attained exactly as planned, without any interference from external forces i.e., the environment within which the organisation operates and exists is either completely predictable, totally benign, or under the organisation's full control.

"These three conditions constitute a tall order, so that we are unlikely to find any perfectly deliberate strategies in organisations. Nevertheless, some strategies do come rather close, in some dimensions if not all"

(Mintzberg & Waters, 2006, p 258).

However, Minztberg also postulates about totally emergent strategy, where "there must be order-consistency in action over time-in the absence of intention about it. (No consistency means no strategy or at least unrealized strategy-intentions not met.)" (Mintzberg & Waters,

2006, p 258). He acknowledges that the total absence of intention would be as rare as the purely deliberate one. Thus, he states that deliberate and emergent strategies form the poles of a continuum, as shown in figure 2.3.2 and strategies would combine various states of the dimensions. From this, Mintzberg created some strategy dimensions, where, depending upon the actors' abilities and their organisation's environment, some common features could be gleaned and identified as shown below.

Strategy	Major features
Planned	Strategies originate in formal plans: precise intentions exist, formulated and articulated by central leadership, backed up by formal controls to ensure surprise-free implementation in benign, controllable or predictable environment; strategies most deliberate
Entrepreneurial	Strategies originate in central vision: intentions exist as personal, unarticulated vision of single leader, and so adaptable to new opportunities; organisation under personal control of leader and located in protected niche in environment; strategies relatively deliberate but can emerge
Ideological	Strategies originate in shared beliefs: intentions exist as collective vision of all actors, in inspirational form and relatively immutable, controlled normatively through indoctrination and/or socialization; organisation often proactive vis-à-vis environment; strategies rather deliberate
Umbrella	Strategies originate in constraints: leadership, in partial control of organizational actions, defines strategic boundaries or targets within which other actors respond to own forces or to complex, perhaps also unpredictable environment; strategies partly deliberate, partly emergent and deliberately emergent
Process	Strategies originate in process: leadership controls process aspects of strategy (hiring, structure, etc.), leaving content aspects to other actors; strategies partly deliberate, partly emergent (and, again, deliberately emergent)
Unconnected	Strategies originate in enclaves: actor(s) loosely coupled to rest of organisation produce(s) patterns in own actions in absence of, or in direct contradiction to, central or common intention is; strategies organizationally emergent whether or not deliberate for actor(s)
Consensus	Strategies originate in consensus: through mutual adjustment, actors converge on patterns that become pervasive in absence of central or common intentions; strategies rather emergent
Imposed	Strategies originate in environment: environment dictates patterns in actions either through direct imposition or through implicitly pre-empting or bounding organizational choice; strategies most emergent, although may be internalized by organization and made deliberate

Figure 2.3.2b - Summary description of types of strategies (Mintzberg & Waters, 2006, p 270)

The business strategy in an SME is often down to one person, the entrepreneur and a strategy has been identified which may match this type of organisation, as on the following page.

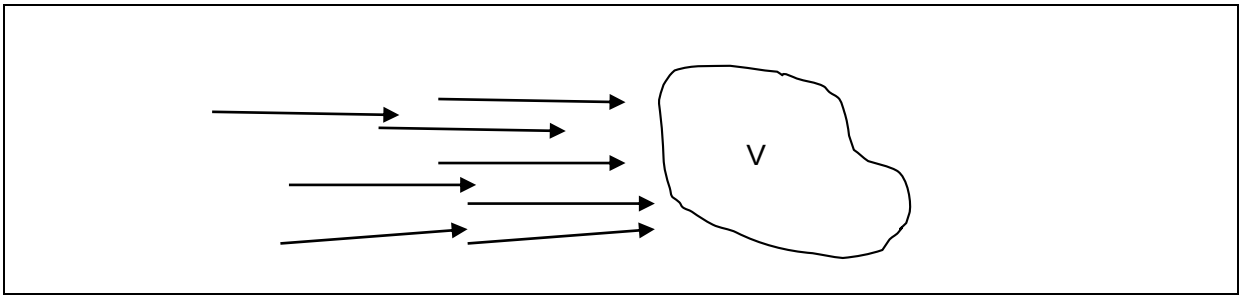

Figure 2.3.2c - Entrepreneurial Strategy (Mintzberg & Waters, 2006, p 260)

This type of strategy has a more relaxed approach to the condition of precise, articulated intentions. Here, the one individual in personal control of the organisation is able to enforce their vision of direction on it.

> *"The force for pattern or consistency in action is individual vision, the central actor's concept of his or her organisation's place in its world. This is coupled with an ability to impose that vision on the organization through his or her personal control of its actions... But entrepreneurial strategies most commonly appear in young and/or small organizations (where personal control is feasible), which are able to find relatively safe niches in their environments. Indeed, the selection of such niches is an integral part of the vision."*
>
> (Mintzberg & Waters, 2006, p 260)

The intentions do exist but they originate from one entity that need not articulate or elaborate them is typically unlikely to want to do so. In two aspects, the strategy can have emergent characteristics:

1. The vision provides only a general sense of direction and, as such, there is room for adaptation. i.e. the details of the vision can emerge as progress is made.
2. The leader's vision is personal making it possible to be changed completely. Since the "formulator is the implementer, step by step, that person can react quickly to feedback on past actions or to new opportunities or threats in the environment. He or she can thus reformulate vision." (Mintzberg & Waters, 2006, p 671)

It is this flexibility that distinguishes the entrepreneurial strategy from the planned. Plans from a single source, providing that person learns, appear to be more flexible than those that cascade through hierarchies, which are made of many people.

> *"Psychologists have shown that the articulation of a strategy locks it into place, impeding willingness to change it (e.g. Kiesler, 1971). The separation of implementation from formulation gives rise to a whole system of commitments and procedures, in the form of plans, programmes and controls elaborated down a hierarchy."*
>
> (Mintzberg & Waters, 2006, p 671)

The idea of one person, being able to change their mind about something compared to a lot of people having to be consulted or coerced into a change, is the primary factor in an SME's

flexibility, providing that individual is willing and able to change. This can be vital if the next step of the SME's progression is beyond the entrepreneur's ability, or willingness, to conceive or understand.

2.3.3 Management

Entrepreneurs identify new markets to support, which leads to a rise in specialist firms in many industries. However, the SME sector is unforgiving, with 50% of all SMEs failing within their first three years (Burns, 2001). Failure often is not due to poor business ideas but is caused more by a lack of understanding of the management issues required in order to be successful (Storey, 1994).

SMEs may be perceived to constitute the most important section of the national economy with over 90% of companies in the U.K. employing less than 250 people. Whilst the adoption of Information and Communication Technology (ICT) is seen as a key to the modern corporate goals of innovation, agility, knowledge management, e-business and organisational learning, managing its adoption can be problematic in smaller organisations (SMEs) who do not have large budgets or the time to invest in appropriate resources.

Maguire and Koh (2007) surveyed over 200 SMEs, including a selection of 15 follow up interviews, to investigate how SMEs are using ICT to gain competitive advantage. Their findings indicated that SMEs are not able to take advantage of ICT development and strategic management methodologies and techniques developed for large firms, that SMEs do not take advantage of supply chain management and customer relationship management applications and that they do not use knowledge management techniques. The two most significant impediments to ICT adoption were seen as a lack of time to take advantage of ICT and secondly a lack of trained staff to purchase, manage, operate and maintain the ICT. They also found that the adoption of e-business by SMEs varies by industry; the highest levels of adoption being seen in the professional services sector and that a major constraint for small firms was their inability to make the necessary investment to take advantage of new ICT innovations and their reliance on outside consultants (also seen as expensive and problematic). In fact Bennett and Robson (1999) even question the role of outside consultancy advice and assistance offered to SMEs as being fragmented, of variable quality, of suspect independence and dubious motivation. A reliance on informal (and tried and trusted) support networks for ICT purchase, implementation and maintenance is therefore seen as vital in most cases.

Research into the strategic and operational management of ICT within SMEs is also surprisingly under-developed (Cragg, 2002). Innovation and agility within organisations are

increasingly cited as desired core competences which often depend on effective and creative use of ICT (Fraser, Conner & Yarrow, 2003). This is an area of developing research which focuses on people, organisation and culture as the important variables that enable or inhibit effective ICT adoption, implementation and use. More rigorous research studies such as that undertaken by Caldeira and Ward (2003) utilise in-depth case study research methods. Caldeira and Ward studied twelve Portuguese manufacturing SMEs to consider how resource-based theory could be used to explain success with the adoption and use of ICT. They used the concept of core competences which involves viewing the assets and resources of a firm from a knowledge-based perspective. This is combined with a framework comprised of four dimensions: internal context, external context, process and content. These key determinant factors are linked to three sets of associated skills and competences; technical IS/IT skills, managerial IS/IT skills and business and general management skills.

This links more generally with research into the strategic management practices of small firms. Stonehouse and Pemberton (2002), in their survey of over one-hundred and fifty SMEs, found that the main business planning method in use within small firms was internal financial analysis. There was little evidence of any other methods, techniques or practices associated with strategic planning (including ICT). Southern and Tilley (2000) also comment on the dearth of research on small firm adoption of ICT, despite its fundamental importance to the global economy and major government policy initiatives. They state that a common cause of problems is the lack of understanding of small firm context and culture: many approaches attempt to apply standard IT management methods, systems analysis and development techniques within a context for which they were not originally designed. Such technologically deterministic approaches may be inapplicable to loose and unstructured organisations where there are low levels of IT skills and experience and which are highly centralised in terms of decision making – usually with power vested in the owner manager of the small company.

With the introduction of personal computers, file servers and networks, small firms have the opportunity to take advantage of the same technology that large business has access to, i.e. e-mail and the development of company web pages to reach larger markets; integrated Enterprise Resource Planning (ERP) systems, and electronic data interchange (EDI) that could allow small firms to link with customers and suppliers (Pollard & Hayne, 1998). However, the question still remains as to whether SMEs can utilise IT strategically; that is, in ways which give competitive advantage. There is evidence that the managers of smaller firms are understandably more concerned with operational issues than the managers of larger organisations (see, for example, (Rivard, Boisvert & Talbot, 1988)).

A particularly interesting relevant piece of research into SMEs and ICT was conducted in 2006 by the WestFocus consortium, comprising researchers from seven West London Universities including Brunel, Kingston and Royal Holloway (WestFocus Project Team, 2005). Around four-hundred SMEs in the Food, Logistics, Media and Internet Services (industries that are particularly important to the economy of the area) were contacted by phone. Over fifty of these also provided follow up, face-to-face, in-depth interviews. The research aim was to identify SMEs' good practice but also identify areas for concern. Unlike the earlier literature, some of which is cited above, the report is quite complementary about the SMEs it featured, and commented on their ''enormous creativity and self-reliance'. Its main criticisms were reserved, not for the SMEs themselves, but for the ICT 'supply-side', and for government policy. The 'provision of effective ICT support to SMEs' was viewed as 'area of market failure'; and although the support for SMEs has been 'a key policy aim of successive UK governments', there is implicit criticism of the effectiveness of this support, which has been 'subject to many changes over the years with a succession of different initiatives in evidence'. Whilst it is unlikely that the report's findings would be representative of the situation of a construction SME, there may be valuable conclusions to be drawn from a comparison of the WestFocus results, with the findings of the present study.

2.3.4 Culture

ICT has been introduced in the construction industry for many years, mostly through its various professions based upon their needs. "There has been little regard of the use of IT within a process framework" (Aouad *et al.*, 1999, p 132). This has led to an uncoordinated approach with the application being established by availability rather than suitability.

These independent IT systems can cause dysfunctionality in the process infrastructures which they are expected to support. "It is evident that the uptake of IT systems by those responsible for designing and operating the industry's systems has been broadly technology-led, with the industry using basic communication tools in a widespread (but not comprehensive) manner, and that the application of particular industry specific tools is more localised, probably because of communication problems." (Aouad *et al.*, 1999, p 135)

This, it is argued, is partly due to a lack of understanding of the way in which the organisations operate. A deficiency in the appreciation of how information technology supports compounds the issue, especially when looking at more sophisticated levels of analysis such as the organisational capability and maturity of the company (or industry). (Aouad *et al.*, 1999). Added to this is the specific issue of resource availability that SMEs incur, especially the limited availability of IT experts.

2.3.5 Agility and Flexibility

SMEs have the reputation of being able to respond readily to customers' changing needs. Several reasons are cited for this form of flexibility. According to Levy and Powell (1998, p 185) the reasons are as follows: First, the owners of SMEs have considerable knowledge about the firms' capabilities. Second, SME management structures tend to be flat and there is an absence of bureaucracy since management teams are small and most SMEs managers work together closely on a day-to-day basis (Levy & Powell, 1998, p 185). The notion of SME agility is described throughout this chapter.

2.3.6 Technology Uptake

As an SME's management structures formalise, they require improved information across a larger and more disparate workforce. An information system (IS) is integral to the management development process. However, they are often simple in the early stages of a firm's development and growth. The use of spreadsheets to manage accounts is superseded by the adoption of a relatively simple accounting package. (Brown & Lockett, 2004)

During the firm's growth, the management of customers effectively becomes vital, and databases begin to be used. Many SMEs have local area networks (LANs) and the use external e-mail, whereas internal e-mail tends to be used in larger SMEs in order to improve communication and control. It is often at this point that SMEs develop brochure-ware type Web sites. However, there is little evidence of successful e-business in SMEs (Brown & Lockett, 2004).

However, SMEs' adoption of new technologies is generally cautious and dependent upon proven robustness. The decision to invest is a combination of identifying value to the business, customer demand, and improving communication. Thus, systems in SMEs evolve over time, but the premise upon which individual firms consider adoption is likely to remain the same.

There is an underlying dynamic in IS adoption as firms grow and develop formal management structures. Exchange of information within the firm requires more effective management IS. The most common strategic response to growth is movement from efficiency to coordination, as SME owners continue to perceive IS as a cost. The firms are those that are comfortable with steady growth to a limited level. These SMEs follow an evolutionary IS path with internal integration (Venkatraman, 1994) through the use of LANs or intranets. IS is used primarily to support existing processes, and little thought is given to

reviewing business processes. However, as IS use grows, SMEs start to recognize that structural change may improve internal communication. (Powell & Levy, 2006)

While the owner has a clear idea, it is not always communicated through the firm. Additionally, goals often are seen in purely financial terms, whereas SMEs can focus more usefully on customers, innovation, and organization. Business process review ensures consistency with business goals. Hence, an organizational approach to ISS that focuses on the organizational enablers and inhibitors of information flow and on the relationship among strategic, tactical, and operational information requirements is most useful for SMEs. In many SMEs, the issue is not additional IS but rather better use of existing systems in order to exchange knowledge. (Powell & Levy, 2006, p ii)

2.3.6.1 ICTs in SMEs

As discussed earlier, SMEs are generally regarded as flexible organisations that can respond quickly to customers' requirements. However, flexibility does not extend to IS adoption or use. SMEs that adopt IS without considering strategy are unlikely to gain business benefits due primarily to the perception of IT as a drain on limited SME resources rather than as an opportunity for growth (Levy & Powell, 1998). Another reason is the failure to recognise the need for changes in organisational and management structures that may be required by IT adoption. Hence, an ISS approach needs to take a more inclusive view of these aspects (Levy & Powell, 2000, p 68).

Whilst the adoption of Information and Communication Technology (ICT) is seen as a key to the modern corporate goals of innovation, agility, knowledge management, e-business and organisational learning, managing its adoption can be problematic in smaller organisations (SMEs) who do not have large budgets or the time to invest in appropriate resources. In the Construction Industry in particular, the proportion of SMEs is above that of the UK economy in general and there are problems related to adopting ICT innovations. Most companies simply do not do it.

Current research indicates that SMEs within the Construction Industry are not very innovative or active in terms of developing, implementing, adopting and diffusing new information and communications technologies (Acar *et al.*, 2006). Research to date (Acar (2006), Anderson (2001), Mak (2001) & Rivard (2000)) has mainly focused on, and benefited, large construction enterprises who are developing complex distributed computer systems for co-ordination and management of project activities across diverse geographical locations.

SMEs, due to their nature, seem to need to see any new system's added value to existing manual systems before making any commitment to bring in new technology. The only way to measure added value is to know what value the existing systems have. Again, there is little published material in this field as most studies need to have a high level of confidentiality (Brock, 2000). In a review of ICT within small firms, Brock found that comparatively little research exists in the area of ICT within small business (as opposed to large organisations). In the SME context, he cites major concerns including; the importance of the unavailability of internal IT skills, that top management support is moderated by the owner-manager relationship and centralised decision making, lack of user participation and, in many cases, a total reliance on the external support of IT vendors and consultants. Most small firms restrict IT usage to administrative tasks; mainly their accounts. (Brock, 2000) concludes by stating that there is a crucial need to develop internal ICT knowledge, skills and consequences (both owners' and employees') and not to have total reliance on external vendors. This must be combined with better user-training and greater participation in the adoption and implementation process. (Barker, 2000) in "Mind the Gap! Information and Communications Technologies and Small Firms" discusses major themes that he and his team of Action Researchers discovered during their investigations.

As a starting point he considers the role of suppliers of systems and their components. The argument is that they are only interested in selling the products and are not concerned with their use. The buyers are mainly interested in the output of these products meaning that "buyers and sellers are effectively speaking two different languages" (Barker, 2000, p 4)

The following area of discussion involves the volume and quality of training involved in operating the new systems. (Barker, 2000) states that traditional training methods may not be enough and that, due to limited resources (both time and money), SMEs tend to be resistant to making the necessary investment. This investment issue is exacerbated by the continual upgrading, development and flow of new products that is common with ICT, especially if something has disappeared due to a new way of working, making the system and its use, obsolete in a very short space of time.

> *"ICT does not simply affect the operation of different parts of the firm; it creates completely new ways of doing business. This presents a major potential threat to the small firm, in that it may find itself completely excluded from these ways of doing business."*
>
> (Barker, 2000, p 5)

One area of 'promise' for the small firm is the opportunity that the inevitable business process re-engineering (BPR) allows for monitoring and managing the processes in order to maximise their effectiveness. This is not usually the main aim of and SME as it tends to be

continually involved in its daily routine, rather than the policing of the operation. It also brings in new management methods, potentially creating a ‘virtual office’ for geographically diverse operations, such as construction companies with other sites. Other opportunities are available for different functions within the firm, such as Purchasing, operations, marketing, accounts and personnel. All of these may assist in the overall decision making of the firm.

However, with opportunities, there are threats. A lack of awareness or preparation for the opportunities available is a major issue to small firms, who may miss out in spite of their initial uptake of the technologies available.

In the Construction Industry where the proportion of SMEs is above that of the UK economy in general, there are problems related to adopting ICT innovations. This is in contrast to the findings from Maguire and Koh ((2007) that the highest levels of SME ICT adoption are to be found in the professional services industry section. The issues and problems highlighted in this general research on ICT adoption, implementation and use in SMEs are further amplified by studies carried-out in a construction-specific context. Aranda-Mena and Stewart (2004) in their review of the Australian construction industry found that adoption of e-business technologies significantly lagged behind other service and product industries. This was due to impediments that were emphasised by the particular nature of construction. Twenty-two such ‘impediments’ were identified and these related to specific organisational types and cultures associated with construction SMEs. They included: confidence/trust; IT skills training/literacy; cultural change; business process change; initial financial cost; privacy issues; goods or services unsuitable for e-sale; loss of current clients; uncertainty of financial returns; lack of reliable measurement; need for face to face communication; management commitment; maintenance running costs; connection speed; technological updates; government support and information; quality or reliability of current infrastructure; user authentication and fraud; not sure of benefits; dissatisfaction with performance.

Aranda-Mena and Stewart (2004) in a discussion of their findings found that both the evident and perceived impediments for e-business had differing levels of impact according to the organisational types such as: SMEs, Contractors, Consultants and Suppliers. Issues associated with degree of risk associated with ICT adoption led to a reluctance to invest and a ‘wait and see’ attitude for Construction SMEs. Trust was also seen as a major concern due to the nature of construction business being based on face to face transactions. The non-standard aspects of goods were a main issue for suppliers. Contractors cited issues related to running costs, financial fraud, process and cultural change as well as concerns over projects considered to be temporary or short term. Consultants quoted issues related to

risks, legal issues, dispute resolution and the protection of intellectual property as being of major significance for conducting business electronically and the major uptake of ICT.

Lofgren (2007) also investigated e-business technology adoption focusing on mobile computing in the Construction Industry. His findings supported the case that in the Construction Industry, despite massive efforts to improve processes with ICT, firms have not increased productivity to the same extent as other business fields. The use of ICT by contractors and site workers was seen as surprisingly low.

The literature on SMEs generally and construction SMEs specifically, indicates that there are significant problems associated with the management, adoption, implementation and use of ICT, both for internal use and external e-business applications. These are associated with the strategic mind sets, culture, context and operational practices of small businesses and their perceived attitudes to ICT – especially those with a strong owner-manager structure. Many research studies to date have identified inhibitors and impediments to ICT and e-business adoption, with serious challenges to adoption being identified. A fundamental paradox is apparent that, despite step changes in technological developments and capability, the opportunities afforded by innovative ICTs are not being harnessed for increased operational efficiencies or new strategic competitive advantages. New and deeper insights are therefore needed in order to understand if and how these issues may be overcome within the overall financial, resource and trust constraints that are typical in Construction SMEs.

Research into the strategic and operational management of ICT within SMEs is also surprisingly under-developed (Cragg, 2002). Innovation and agility within organisations are increasingly cited as desired core competences which often depend on effective and creative use of ICT (Fraser, Conner & Yarrow, 2003). This is an area of developing research which focuses on people, organisation and culture as the important variables that enable or inhibit effective ICT adoption, implementation and use. More rigorous research studies, such as that undertaken by Caldeira and Ward (2003), utilise in-depth case study research methods. Caldeira and Ward studied twelve Portuguese manufacturing SMEs to consider how resource-based theory could be used to explain success with the adoption and use of ICT. They used the concept of core competences which involves viewing the assets and resources of a firm from a knowledge-based perspective. This is combined with a framework comprised of four dimensions: internal context, external context, process and content. These key determinant factors are linked to 3 sets of associated skills and competences; technical IS/IT skills, managerial IS/IT skills and business and general management skills.

This links more generally with research into the strategic management practices of small firms. Stonehouse and Pemberton (2002) in their survey of over one-hundred and fifty SMEs found that the main business planning method in use within small firms was internal financial analysis. There was little evidence of any other methods, techniques or practices associated with strategic planning (including ICT). This is despite a lot of research evidence suggesting a strong positive relationship between overall performance of SMEs and the degree of long term planning undertaken. Southern and Tilley (2000) also comment on the dearth of research on small firm adoption of ICT, despite its fundamental importance to the global economy and major government policy initiatives. They state that a common cause of problems is the lack of understanding of small firm context and culture: many approaches attempt to apply standard IT management methods, systems analysis and development techniques within a context for which they were not originally designed.

With the introduction of personal computers, file servers and networks, small firms have the potential to take advantage of the same technology that large business has access to, i.e. e-mail and the development of company web pages to reach larger markets; integrated ERP systems, and electronic data interchange (EDI) that could allow small firms to link with customers and suppliers (Pollard & Hayne, 1998). However, the question still remains as to whether SMEs can utilise IT strategically; that is, in ways which give competitive advantage. There is evidence that the managers of smaller firms are understandably more concerned with operational issues than the managers of larger organisations (see, for example, Rivard, Boisvert & Talbot, 1988).

The issues and problems highlighted in this general research on ICT adoption, implementation and use in SMEs are further amplified by studies carried-out in a construction-specific context. Aranda-Mena and Stewart (2004) in their review of the Australian Construction industry found that adoption of e-business technologies in construction significantly lagged behind other service and product industries. This was due to impediments that were emphasised by the particular nature of the industry. Twenty-three such ‘impediments’ were identified and these related to specific organisational types and cultures associated with construction SMEs. They included: privacy, trust, uncertainty of financial returns, lack of reliable measurement, fraud, and lack of support and systems maintenance. Löfgren (2007) also investigated e-business technology adoption focusing on mobile computing in the Construction Industry. His findings also supported the case that in the Construction Industry, despite massive efforts to improve processes with ICT, firms have not increased productivity to the same extent as other business fields. The use of ICT by contractors and site workers is seen as surprisingly low.

One proposed reason for SMEs' limited view of ICT planning is that most invest incrementally and in response to a very specific requirement such as improving basic administration tasks or financial reporting. These can result in SPEs using “simple” IS for more complicated procedures than has previously been identified. Interestingly, the by using this information, managers begin to develop strategies for the organisation, hence IS can have value for SMEs. However, it is these IS strategies that SMEs need to develop and this is a key task for researchers and practitioners in the industry (Levy & Powell, 2000, p 64).

Of the IS strategies have been investigated in the past, strategic focus was the dominant topic throughout 1980s. There is an argument by Checkland and Holwell (1998) that an organisational perspective is now in vogue. They claim that the strategy must be related to predominant organisational culture, meaning that there is a need to understand the underlying culture and values within the organisation. This would go some way to identifying difference between the anticipated IS strategy that is identified from the overall business strategy compared to the realised strategy that depends on appreciating organisational issues that inhibit success (Levy & Powell, 2000, p 67).

3 Research Framework

3.1 Introduction

The literature review in Chapter Two led the researcher to ask if research theories and methods commonly used in Construction Industry research were apt for the work required on this project. The premise is that there are conflicting concepts within the overall thesis topic of MIS Adoption within Construction SMEs requires investigation. Chapter Two illustrates the range of issues that the researcher observed into three distinct areas; Business Processes, SMEs and IS adoption, all within the context of Construction SMEs. This literature groundwork helped to identify the method and techniques in which the topic could be examined.

> *"...research in the information systems field examines more than the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact."*
>
> (Lee, 2001)

3.2 Theory Building

This thesis has two clear areas of study; Small and Medium Enterprises (SME) in the United Kingdom (UK), specifically in the construction industry, and Information Systems (IS) adoption. Within these fields, academics, mostly Management School or IS specialists, have built theories in order to explain the actions, interactions and non-actions taking place within their studies. By combining these two areas, the researcher must look to both 'camps' in order to find a suitable framework that can explain the events that took place.

> *"For at least the last 20 years, the field of small business research has played a unique role in the development of entrepreneurship research. Przeworski and Teune (1969) suggest that ". . . the criteria of generality . . . imply that the same theories must be evaluated in different systemic settings and that social science theories can gain confirmation only if theories formulated in terms of the common factors constitute the point of departure for comparative research (p22)"*
>
> (Tan et al., 2009, p234).

They go on to describe good research in small business should be guided by good theories effected by good methods suggesting three criteria; generalisability, simplicity and accuracy.

> *"As each method has its own advantages and limitations, there are inevitably tradeoffs. For instance, in recent years, complexity theory rooted in natural science and social network theory originating in sociology, have drawn more and more attention in mainstream management research, because the complex network and*

> *complex adaptive system perspectives offer new lenses for observing the coevolution between environment and firm strategy"*
>
> (Tan et al., 2009, p241)

However, the more traditional, case-study approach may be very accurate as they tend to have detailed records and descriptions. This does not fit well with the simplicity and generalisability criteria. (Tan *et al.*, 2009) They then use a somewhat apt simile (in relation to this thesis) to describe their observations.

> *"Let us consider research phenomena to be like nails, and that our task is to drive them into boards. Then in scientific research, theories and methods are the hammers. We choose different hammers for different nails, so they can work well together. However, what we increasingly observe in management research in general, and small business research in particular, is that students are trained with certain theoretical perspectives and research methods, and they hold tightly to these hammers looking for proper nails that fit their hammers. (Tan et al., 2009, p241)*
>
> *"If no "hammer" in management field can drive the "nail," we then must borrow "hammers" from other disciplines or design appropriate new "hammers" with them to then drive the "nail."*
>
> (Tan et al., 2009, p242)

To add to the simile, the researcher also asks from where you are hammering the nail. Do you need to be left-handed, upside down, etc.? Surely the position of the hammer user will affect the way the nail is attacked.

According to Wainwright & Small (2004), "adopting a constructionist epistemological position to research in the field of Information Systems (IS) is now becoming increasingly accepted within studies investigating the complex interactions that take place between individuals, groups, and organizations when developing and implementing new information and communication technologies". They go on to describe the volume of different theoretical perspectives, methodologies and methods that are available, often chosen logically, subject to the situation and context of the project, or irrationally, due to bias, historical beliefs, academic social pressures or opportunism. Increasing interest is being shown (Kemmis, 2001, for example) in the research approaches that facilitate participation and attempt to provide emancipatory potential; "creating the potential for shared ownership of research projects and providing useful outcomes for both researcher(s) and the research subject(s)" (Wainwright & Small, 2004). Kemmis (2001) combined two research approaches. With Critical Social Theory (CST) as a theoretical perspective, Participatory Action Research (PAR) is a methodology that may be a promising approach to researching complex situations where social, historical, cultural, political and power factors may be the main determinants controlling change and inhibiting conditions for effective learning within organizations. These theoretical issues are examined in terms of the role of the researcher

upon entering the research domain, the immediate and continuing interaction of both researcher and subject(s) and the transitions that take place in terms of embedding the research within the organisation as a learning process.

The researchers' role is critical in any study undertaken. The reflexivity, verification and validity of the study are driven by the researcher's approach and reporting of the 'story'. Alvesson and Skoldberg are quoted in Van De Ven (2007) as saying "What is important is that the reflection is adapted to one's own personal abilities, the context of the problem being investigated, and to the perspectives of the stakeholders directly affected by the research project being undertaken."

The purpose of this chapter is to establish how the researcher captured all of the sub-topic's attributes and examined their relationships. This chapter discusses the research perspective, followed by a discussion of the theory of the Social Construction of Technology (SCOT). It then considers the suitability of the case study method then, finally, the data collection and analysis techniques.

3.3 Theories of ICT Adoption

In order to analyse the project, there needs to be some idea of the models available to structure the project. Some of these are 'professional' and formal, such as Prince2, and some are more theoretical and academic, for example, SCOT.

3.3.1 Models

Three of the most commonly used and known formal, or 'professional' models are Structured Systems Analysis and Design Methodology (SSADM), Structured Analysis and Design Technique (SADT) and Projects in Controlled Environments (Prince2). They have all derived from large scale computer and software development programmes since the 1970s and 80s. SSADM deals with the whole project lifecycle and is based on the more traditional approach to IT, which requires complete documentation and definitions all of the system requirements before the project starts. This is a very document intense system.

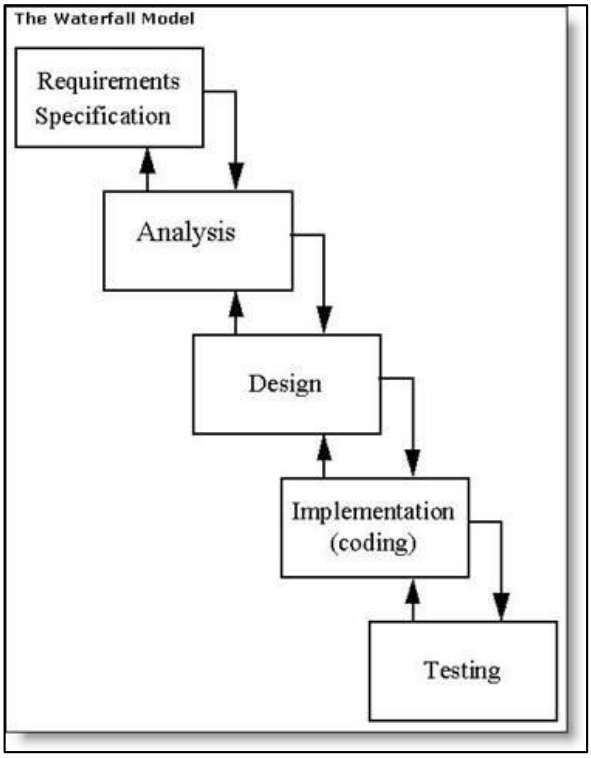

Figure 3.3.1a - SSADM 'Waterfall Model', (Scottish Qualifications Authority, 2007)

SSADM concentrates on the analysis and design phase of the Systems Development lifecycle, as shown in the diagram above and "favours a functional decomposition approach - the problem is split into ever-smaller functional chunks", which "tend to build monolithic applications in the best 60s style which are hard to maintain and hard to integrate" (Scottish Qualifications Authority, 2007). This, added to the requirement of expert analysts and practitioners, makes the system very costly to train for and implement.

SADT is another system based upon software engineering, describing systems as a hierarchy of functions. It uses a system of notation to describe 'objects', such as data, information, etc., which are passive and 'events', which could include operations, activities, and processes, all of which are active (Myopoulos, 2004, p2). This notation can represent differing levels of the system, from the overall system, down to the finest detail and is very hierarchal. The diagram on the next page shows the notation in its official form.

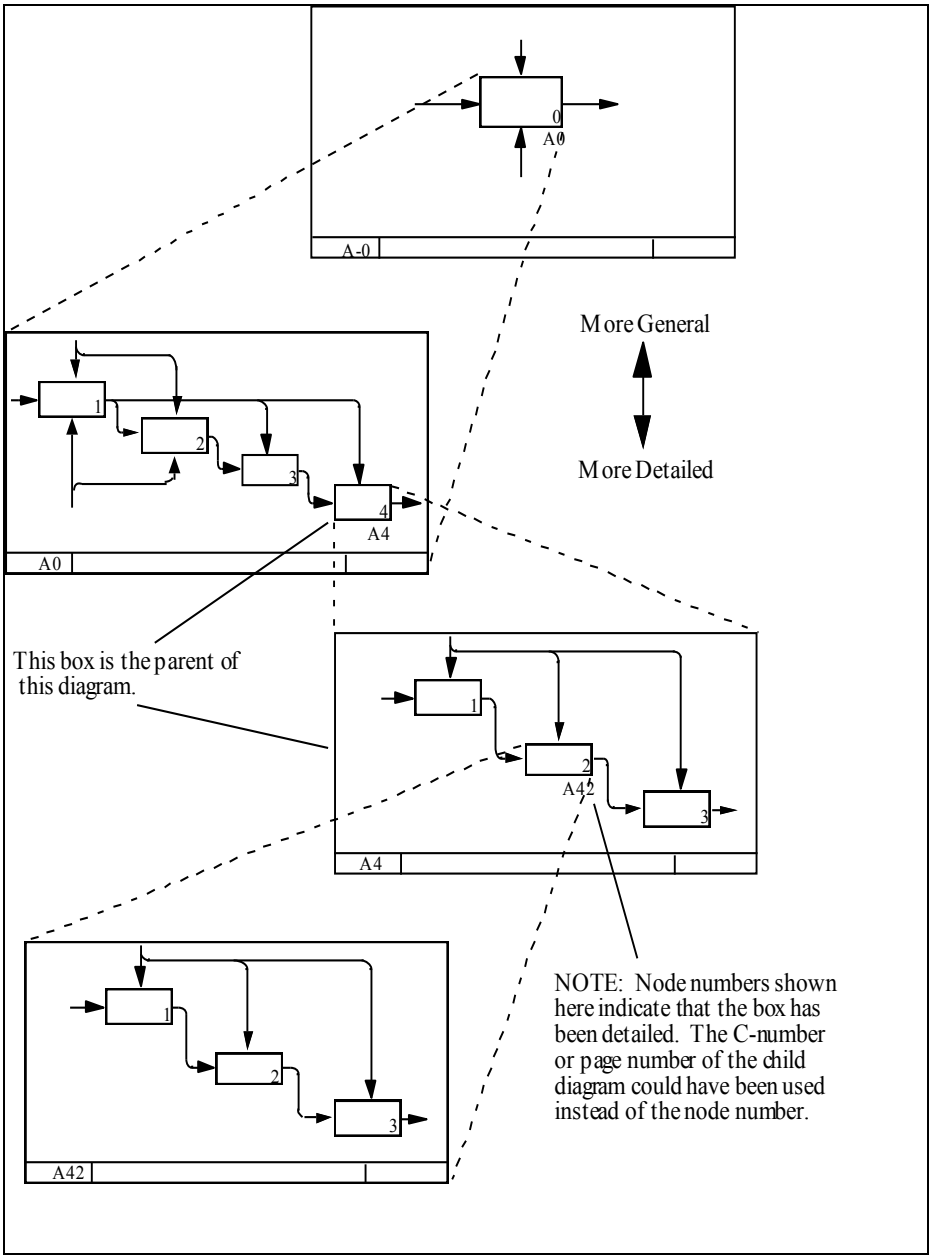

Figure 3.3.1b - Decomposition Structure, (National Institute of Standards and Technology, 1993, p16)

Again, the complex training and adoption of this system lends itself to large organisations with complex software projects.

Prince2 has developed over the years to encompass more of the project management issues. Although it was launched in 1996, its origins can be traced to a project management method, PROMPT, created in 1975 and adopted by the Central Computer and Telecommunications Agency (CCTA, then the Office of Government Commerce and now the Cabinet Office) in 1979 as the standard to be used for all Government information system projects. PRINCE was established in 1989 by CCTA and superseded PROMPT within UK Government projects (The Cabinet Office, 2012).

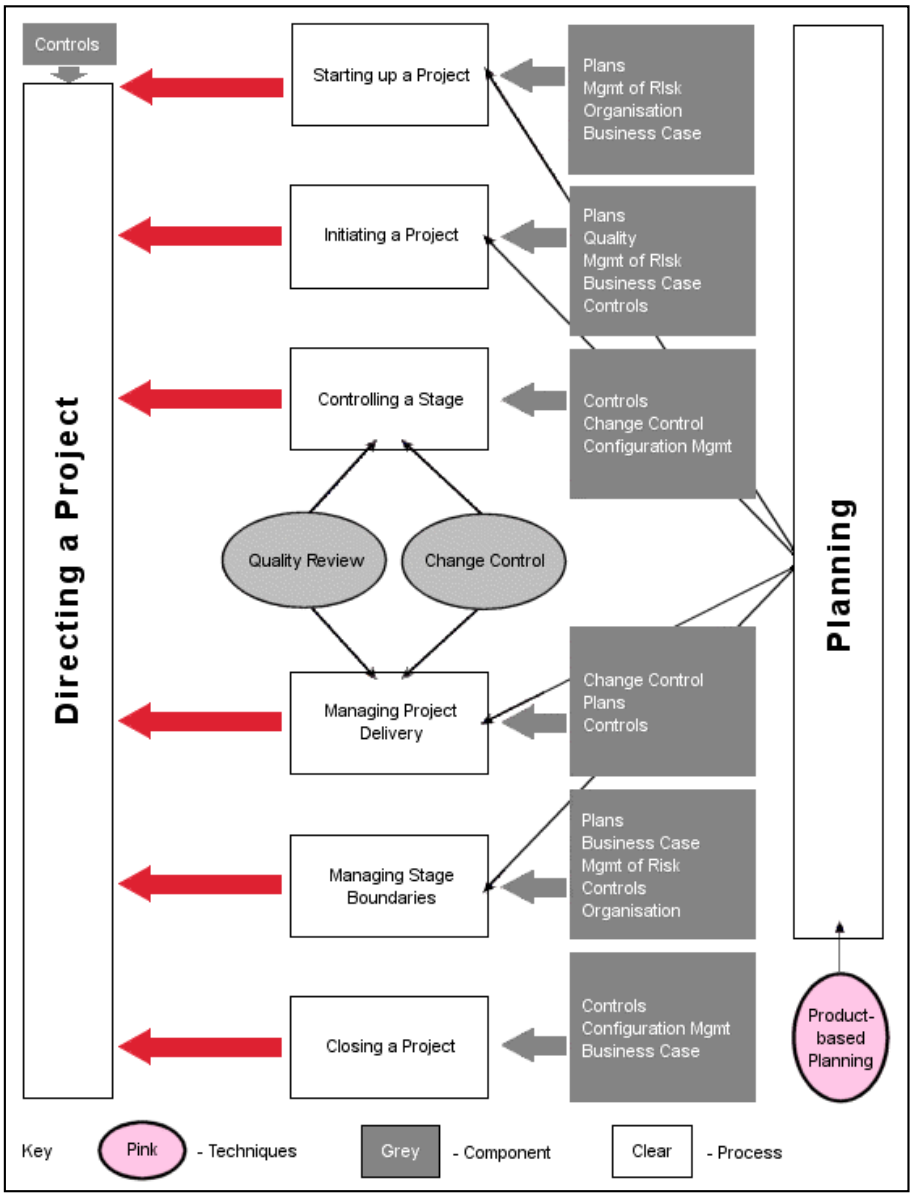

Figure 3.3.1c - Prince2 Components and Techniques, (Wideman, 2002)

The Prince2 diagram is very different to the previous two, in that it is process oriented, rather than object focused. Indeed, it is advertised as “a process-based approach for project management providing an easily tailored, and scalable method for the management of all types of projects. Each process is defined with its key inputs and outputs together with the specific objectives to be achieved and activities to be carried out.” (The Cabinet Office, 2012)

However, all three have an intense system of documentation, with an auditable trail necessary in order to recheck the progress of the process. This makes them very cumbersome and difficult to adopt in small, resource limited organisations. The formal structure appears at odds to SME requirements and approach to working. They are also very

limiting in that they are prescriptive and positivist in their method i.e. there is a predetermined knowledge of both the problem to be rectified and the process about to be undertaken necessary before any project begins. This approach is not suited to SMEs, who need to 'learn-as-they-go' due to knowledge and resource limitations, as mentioned in Chapter Two. Also, these approaches do not account for the social arena within which the projects take place meaning a different viewpoint to the traditional positivist stance must be examined. As described before, Wainwright & Small (2004) noted that a constructionist epistemological position in this field is becoming accepted as it can describe the exchanges between individuals, groups, and organisations.

3.3.2 Social Constructionism

Social constructionism deals with the way social phenomena develop. For this study, the social implications of the Management Information System are key. Berger and Luckmann's book, The Social Construction of Reality (1967) was one of the first proponents of this theory in the United States of America. They argue that knowledge is derived from, and preserved by, the social interactions in which they are located. This is due to person to person interactions and the expectation that an individual's respective perceptions of reality are related. "I cannot exist in everyday life without continually interacting and communicating with others" (Berger & Luckman, 1967, p37). This is then acted upon and this understanding of their common knowledge of reality becomes reinforced. "I know that I live with them in a common world. Most importantly, I know that there is an ongoing correspondence between my meanings and their meanings in this world, that we share a common sense about its reality" (Berger & Luckman, 1967, p37). The particular methods inspiring their conception of social construction have roots in phenomenology, with links to Heidegger and Edmund Husserl. Since this 'common sense' knowledge is negotiated by people, human typifications, significations and institutions come to be presented as part of an objective reality, implying that reality is socially constructed.

However, an absolute definition of what Social Constructionism is difficult to arrive at, due to the many writers using the term. "This is because, although different writers may share some characteristics with others, there isn't really anything that they all have in common. What links them all together is a kind of 'family resemblance'..." (Burr, 2003, p2). The four key elements of Social Constructionism are:

1. We should take a critical stance regarding taken-for-granted knowledge. This notion opposes both Positivism and Empiricism, the assumptions that all things can be revealed by observation alone. " 'What we take to be experience of the world does not in itself dictate the terms by which the world is understood. It begins with radical doubt in the taken-for-granted world--whether in the sciences or daily life--and in a

specialized way acts as a form of social criticism. Constructionism asks one to suspend belief that commonly accepted categories or understandings receive their warrant through observation. Thus, it invites one to challenge the objective basis of conventional knowledge" (Gergen, 1985, p 266-267).

2. We should take into account historical and cultural effects. "The terms in which the world is understood are social artefacts, products of historically situated interchanges among people. From the constructionist position the process of understanding is not automatically driven by the forces of nature, but is the result of an active, cooperative enterprise of persons in relationship. In this light, inquiry is invited into the historical and cultural bases of various forms of world construction" (Gergen, 1985, p 267).
3. We should understand the social processes. "The degree to which a given form of understanding prevails or is sustained across time is not fundamentally dependent on the empirical validity of the perspective in question, but on the vicissitudes of social processes (e.g., communication, negotiation, conflict, rhetoric). As proposed in this case, perspectives, views, or descriptions of persons can be retained regardless of variations in their actual conduct. Regardless of the stability or repetition of conduct, perspectives may be abandoned as their intelligibility is questioned within the community of interlocutors. Observation of persons, then, is questionable as a corrective or guide to descriptions of persons. Rather, the rules for "what counts as what" are inherently ambiguous, continuously evolving, and free to vary with the predilections of those who use them. On these grounds, one is even led to query the concept of truth" (Gergen, 1985, p268).
4. We should understand the relationship between knowledge and social interactions. "Forms of negotiated understanding are of critical significance in social life, as they are integrally connected with many other activities in which people engage. Descriptions and explanations of the world themselves constitute forms of social action. As such they are intertwined with the full range of other human activities. The opening, "Hello, how are you?" is typically accompanied by a range of facial expressions, bodily postures, and movements without which the expression could seem artificial, if not aberrant. In the same way, descriptions and explanations form integral parts of various social patterns. They thus serve to sustain and support certain patterns to the exclusion of others. To alter description and explanation is thus to threaten certain actions and invite others" (Gergen, 1985, p268).

The combination of Social Constructionism and science and technology studies had a huge impact through the works of Michel Foucault. For example, he defines an experience as an interrelation between knowledge, 'types of normativity' and subjectivity in a particular culture at a particular time (Foucault, 1992). He then describes his work as fictions, meaning his writings are constructed stories about the real, rather than absolute representations of what is really there. Foucault also argued against the notion that there is a single foundation for knowledge or explanation for all activity and social organisation. He refuted the idea that there is one principle which explains everything else. Instead, he argued, that it is a "question of the interrelation of a complex and multi-layered range of elements" (O'Farrell, 2009). Other terms given the Foucault treatment are very relevant to this study.

Gaze is a term that he introduces in his 1963 book The Birth of the Clinic. "The French word 'le regard' poses difficulties for translation into English as the translator Alan Sheridan notes. It can mean glance, gaze, look, which do not have the abstract connotations that the word

has in French. Foucault uses the word to refer to the fact that it is not just the object of knowledge which is constructed but also the knower. Clinical medicine at the end of the eighteenth century set much store on visibility - on looking and seeing and on visible symptoms" (O'Farrell, 2009). This is vital to an Action Researcher, one of whose main tasks is to observe. Science and Technology are the other relevant words that Foucault gives an explanation of.

He was interested in science as it had set itself up as the definitive form of rational thought and, with the Enlightenment, "scientific reason became the privileged way of accessing truth" (O'Farrell, 2009). This meant that for knowledge to acquire value as the truth, it had to be scientific. However, he argued that scientific knowledge is not inherently superior or truer than other recognised forms of knowledge. This observation may have serious repercussions upon what is called rigour!

Finally, Foucault preferred the word technology in his writings and used it to encompass the broader meaning of techne, which he defined as "'a practical rationality governed by a conscious aim" (O'Farrell, 2009). This implies that all technology is a tool and all tools are technology, with which to 'do something'.

3.3.3 A More Critical Stance of Social Constructionism

John Cromby and David Nightingale's chapter "What's wrong with social constructionism?" in their edited book "Social Constructionist Psychology: a critical analysis of theory and practice" (1999) takes a critical view on Social Constructionism, and its perceived obsession and dependence with language and discourse.

"The understanding that knowledge is both relative and emerges from practice gives constructionism a powerful critical impetus, placing it in opposition to the positivist, empiricist tradition of science which assumes that "facts" can be gathered by disinterested and neutral observation" (Cromby & Nightingale, 1999, p6). However, they point out that there are divergences centring on the identifying social constructionism's limits. They go on to describe an apparent inconsistency between constructionism proponents known as the realism-relativism debate. Realism includes "perceptions, thought, language, beliefs and desires as well as artefacts such as pictures and maps, and so include all the ways in which we do or could know and experience the world and ourselves" (Cromby & Nightingale, 1999, p6). This doctrine demands that an external world exists autonomously of our interpretations of it. Relativism, however, renounces this principle, stating that "since any such external world is inaccessible to us in both principle and practice then it need not be postulated or

considered" (Cromby & Nightingale, 1999, p6). They then discuss the importance of relativism to social sciences by identifying things, a table, and facts, death.

This uncovers "two complementary dilemmas. The first occurs at those moments when exasperated realists clout the furniture in order to demonstrate its physical existence to pedantic relativists. Edwards et al argue that "not only words signify. The table-thumping does its work as meaningful action, not mere behaviour. Rocks, trees, furniture are not already rebuttals of relativism, but become so precisely at the moment, and for the moment, of their invocation. This can be termed as the realist's dilemma." Second, there is the relativist's dilemma which occurs because relativism "must treat everyone's views as equally valid ... it offers no grounds for caring one way or another on anything moral, political or factual... realists shoot themselves in the foot as soon as they represent, relativists do so as soon as they argue "" (Cromby & Nightingale, 1999, p8).

From this never ending cycle, Cromby and Nightingale argue that we "must strategically deploy the analytical and critical methods we have developed in an attempt to forge a coherent and grounded social constructionism that explains the world, in all its intransigence and mess, since only in this way might we contribute to its progressive transformation" (Cromby & Nightingale, 1999, p10). To accomplish this, they discuss three distinct areas; Embodiment, Materiality and Power. For each of these terms, the authors have a certain criteria for their definitions. Embodiment is listed below and on the following page.

Embodiment	The human body is a site of birth, growth, ageing and death, of pleasure, pain and many things (like mild hunger, or being tickled) that fall between.
	It is an object of desires, whether aesthetic, erotic or narcissistic.
	It is a bearer of features, from retrouche noses and pigeon chests to skins of different hue and primary and secondary sexual characteristics.
	It is a biological machine that provides the material preconditions for subjectivity, thought, emotion and language.
	With other bodies it makes possible physical interaction of all kinds, from passionate kissing to senseless killing.

	Bodies are celebrated in dance, honed in exercise and disciplined in Foucault, they are mended and modified by surgery and adorned by practices such as tattooing and piercing.
	Bodies differ, not just in their characteristics but in their capabilities: not all can touch fingers to their toes or dance all night, some struggle even to walk unaided, whilst others (blind, deaf and mute) can see, hear or speak no discourse.
	Bodies are the intimate place where nature and culture meet; they are the external boundary and principal mass of the mind-body-brain system that we call a human being.
	They are lumpy, smelly, messy, unreliable and ultimately destined to self-destruct.

Figure 3.3.3a - Embodiment (Adapted from Cromby & Nightingale, 1999, p11)

They argue that “studies of discourse typically proceed as though their raw material was not already the product of embodied beings, in seeming ignorance of the fact that talking is not the only form of interaction. In continually either ignoring the body or treating it as mere metaphor or text, social constructionism obscures and downplays the significance of its functional, physiological, hormonal, anatomical and phenomenological aspects” (Cromby & Nightingale, 1999, p11). This implies that there is no such thing as a body in social constructionism, and any other views on this are mistrusted. They then discuss embodied subjectivity.

> *“The subjectivity which is "me" inhabits one particular lump of flesh and no other such lump, and so appears in the context of one, and only one, personal-social life history... Rather than continue along the neo-behaviourist path of pretending that subjectivity does not exist, we prefer to acknowledge and attempt to understand how subjectivity is constituted through embodied interactions, material possibilities and personal-social histories”*
>
> (Cromby & Nightingale, 1999, p11).

Materiality	Materiality refers to the elemental, physical nature of the world in which we are embedded, its "thing-ness" and solidity.
	In addition to the human bodies already more specifically discussed above it includes the physical (as opposed to conceptual or discursive) aspects of tables, rocks, tape recorders and transcripts, books like this

	one, rivers, mountains, oceans, planets, and the dizzying curvature of the space-time continuum.
	Materiality is the wetness of water, the coldness of ice, the viscosity of oil and the grittiness of sand. It is the weight of lead and the lightness of feathers, the fragrance of tree flowers in the spring and of burning leaves in the autumn.
	Materiality embraces the distribution of resources, the location of bodies, the organisation of space and the irreversible fact of time.

Figure 3.3.3b - Materiality (Adapted from Cromby & Nightingale, 1999, p12)

Language is vital when describing the existence of distinctions. For example, the description of snow by indigenous people of Greenland, is far more complex than that of most peoples, especially those who have never encountered snow.

> *"Something that speakers of English would call snow (and Greenlanders might call qanik, pukak, or apirlatt according to its age, texture, and which dialect they spoke) would fall from the sky in certain atmospheric conditions, whether we had words for it or not. Far from demonstrating the ephemeral status of the material world, as is sometimes claimed, this example demonstrates both the diversity of human culture and the rootedness of social, discursive constructions in the material world and the activities of everyday life... Materiality matters because it both creates possibilities for, and puts constraints upon, the social constructions by and through which we live our lives"*
>
> (Cromby & Nightingale, 1999, p12)

Power	Power is a term swathed in confusion, with multiple and sometimes mutually exclusive definitions.
	Even confining ourselves to the social sciences, power is variously seen as a personal attribute or characteristic, as the implementation of strategies or the use of resources, as a commodity which can be "seized", as a structural feature of societal relations, and as a property which flows from and through the use of discourses acknowledged (at least by those who wield them) to be "true".
	We come to explicate power and not to bury it, and so we will accept these multiple definitions and use their inconsistencies to help us develop the potential of social constructionism to analyse and

	understand power and its effects, a potential which the dominant strand of constructionist thought currently fails to fulfil.
	This failure is closely related to the two issues previously described. Whilst constructionism does not adequately address embodiment and materiality and continues to consign subjectivity and personal-social history to its margins, it cannot include power.

Figure 3.3.3c - Power (Adapted from Cromby & Nightingale, 1999, p12)

Cromby and Nightingale claim that embodiment and power are intimately related. However, they also state that power is a material issue.

> *"Power is essential to an understanding of subjectivity, since the personal-social histories from which it emerges are always moulded and shaped by power relationships. Evidence for this in everyday life is provided by research on gender, race and disability; and in extremis by studies of the effects upon individuals of sexual and physical abuse"*
>
> (Cromby & Nightingale, 1999, p13)

They conclude by saying that Social Constructionism's focus on language and discourse has outlived its usefulness.

> *"Such strategies ... are now causing more problems for constructionism than they solve: the discursive turn is threatening to become a discursive retreat. Continuing to ignore or downplay embodiment and materiality may eventually create the conditions for the tide of knowledge and practice to simply sweep social constructionism away...It seems far more likely that social constructionism will simply make itself irrelevant and trivial, and so waste the valuable gains it has made"*
>
> (Cromby & Nightingale, 1999, p 13).

All of these points are well assembled but do come from a psychology viewpoint Burr (2003). They are not dealing with specific 'artefacts' and generalise their discussion in order to encompass all.

3.3.4 The Organisation and Organisational Theory

Jackson et al (2001) note that constructionism can expand to organisational issue and does not only focus on technology. "There is no obligation to foreground the technological artefact itself. Foregrounding the organization means that researchers may dwell on the larger milieu, in which social and technical aspects interact. The main issue, then, is the way in which ICTs insinuate into organizational life" (Jackson, Poole & Kuhn, 2001, p12)

They go on to state that the focus is less about of effects of ICT adoption and more on the stories regarding events and practices within the organisation. In other words, causal

relationships between technology and work might not be a concern. “In this body of research, important constructionist assumptions, including the interplay of social and technical elements, guide investigation of traditional issues such as organizational culture, role hierarchies, or the nature of work. What surfaces from these investigations is the insight that ICTs may have indirect impacts that come less from the use of a specific ICT than from the part the ICT plays in forming or insinuating larger organizational contexts” (Jackson, Poole & Kuhn, 2001, p12).

Another influential factor may be the amount of time that the researcher spends within the organisation. This is vital when looking at the project overall, as the researcher spent years interacting with SMECon and it is mentioned within the Action Research subject field. It is an important step for removal of the researcher from the environment. “The less familiar the organization is to the researcher, the more likely the researcher is to find it more fascinating than ICT and the more likely the focus on construction of the organization in terms of ICT; the more familiar the organization, the more likely the new ICT is to stand out and the more likely its construction will come to the fore” (Jackson, Poole & Kuhn, 2001, p12). They also point to Pettigrew’s observation that the time spent within the environment may bias the researcher’s outlook. ”The more we look at present-day events, the easier it is to identify change; the longer we stay with an emergent process and the further back we go to disentangle its origins, the more likely we are to identify continuities” (Pettigrew, 1990, p271).

However, the researcher was looking at technology’s adoption process within an organisation. He was applying Social Constructionism in a very specific manner – onto technology. The definitions of technology have been discussed earlier and are applied only to human interactions and applications. The following section summarises the seminal work by Pinch and Bijker that lead to the concept of SCOT.

3.3.5 Social Construction of Technology

How people see ‘things’, their perception, is critical when analysing anything. Fashion is a perfect example of this, and indeed, is driven by perceptions. Some people enjoy some things, others prefer other things, and these change with time.

Technology has this effect too. How one person feels about Microsoft (MS) Vista on a personal computer may be completely different to someone else. But why is this the case? Trevor J. Pinch and Wiebe E. Bijker’s seminal paper, The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other attempts to give some sort of explanation with regard to technology.

"Sociological studies of new knowledge in science abound, as do studies of technological innovation, but thus far there has been little attempt to bring such bodies of work together" (Bijker, Hughes & Pinch., 1987, p17). This remark was driven, at the time, by a general observation that technology, innovation and research and development (R&D) were often viewed from an analytical, scientific viewpoint, mainly due to the researcher's own experiences and expertise and their desire to remain within their known field. This led them to look at how science and technology were studied by breaking the topics into three broad areas; the Sociology of Science, the Science – Technology Relationship and Technology Studies.

3.3.6 Sociology of Science

Pinch and Bijker firstly discuss science in terms of its sociology. "The treatment of scientific knowledge as a social construction implies that there is nothing epistemologically special about the nature of scientific knowledge: It is merely one in a whole series of knowledge cultures (including, for instance, the knowledge systems pertaining to "primitive" tribes) (Barnes 1974; Collins and Pinch 1982). Of course, the successes and failures of certain knowledge cultures still need to be explained, but this is to be seen as a sociological task, not an epistemological one" (Bijker, Hughes & Pinch., 1987, p19). They also noted that the social constructivist view was gathering momentum as an important body of work, one which shows a potential use in wider applications.

3.3.7 Science – Technology Relationship

In this relationship, Pinch and Bijker state that "most researchers today seem willing to agree that technological innovation takes place in a wide range of circumstances and historical epochs and that the import that can be attached to basic science therefore probably varies considerably" and "the view prevalent ...that science discovers and technology applies-will no longer suffice . Simplistic models and generalizations have been abandoned"(Bijker, Hughes & Pinch., 1987, p20). They quote Layton (1977) discussing the notion that Science and Technology are not mutually exclusive with the role of scientist and technologist. According to Pinch and Bijker, "researchers concerned with measuring the exact interdependence of science and technology seem to have asked the wrong question because they have assumed that science and technology are well-defined monolithic structures" (Bijker, Hughes & Pinch., 1987, p20).

However, they did note a change in emphasis in the relationship, quoting both Layton (1977) and Barnes (1982) who stated that the historical separation of science and technology through the functions of knowing and doing were abstract and that the relationship was

social. This change in the way of thinking was caused by the realisation that science and technology don't follow one another; rather they are on an equal footing. Barnes stated that "both sets of practitioners creatively extend and develop their existing culture; but both also take up and exploit some part of the culture of the other. . . . They are in fact enmeshed in a symbiotic relationship" (Bijker, Hughes & Pinch., 1987, p21), allowing Pinch and Bijker to say that the "social constructivist view of science and technology fits well with his conception of the science-technology relationship" (Bijker, Hughes & Pinch., 1987, p21). They then go on to discuss technology studies by dividing the literature into three parts: innovation studies, history of technology, and sociology of technology.

3.3.8 Technology Studies

The success, or otherwise, of innovation has been the economists preferred method for Innovation Studies. They researched various aspects of what they called, the innovating firm, using the "size of R&D effort, management strength, and marketing capability along with macroeconomic factors pertaining to the economy as a whole" (Bijker, Hughes & Pinch., 1987, p21). The notion of the mysterious "black box" (Whitley 1972) was how scientific knowledge was regarded for the purpose of these early studies. "Scientists might as well have produced meat pies" (Bijker, Hughes & Pinch., 1987, p21) and within the economic analysis everything was included that might be expected to influence innovation, except the technology. Layton noted "What is needed is an understanding of technology from inside, both as a body of knowledge and as a social system. Instead, technology is often treated as a "black box" whose contents and behaviour may be assumed to be common knowledge. (Layton 1977, p198) However, thirty-two years have passed since this observation and economists have begun to look into the 'black box', albeit in a linear manner.

Pinch and Bijker believe that this criticism may not be aimed at the History of Technology. They do, however, list two issues in relation to the sociology of technology. Firstly, "descriptive historiography is endemic in this field. Few scholars (but there are some notable exceptions) seem concerned with generalizing beyond historical instances, and it is difficult to discern any overall patterns on which to build a theory of technology (Staudenmaier 1983, 1985)" (Bijker, Hughes & Pinch., 1987, p22). Secondly, there is a problem with the asymmetric focus of the analysis. This contributes to the implicit adoption of a linear structure of technological development, which suggests that the whole history of technological development had followed an orderly or rational path" (Bijker, Hughes & Pinch., 1987, p22)

To summarise these three main areas of study, Bijker and Pinch state that they “can say the predominant traditions in technology studies...do not yet provide much encouragement for our program. There are exceptions...” (Bijker, Hughes & Pinch., 1987, p22)

3.3.9 EPOR and SCOT

As a foundation to SCOT, Pinch and Bijker (1985) utilise the three stages of the Empirical Programme of Relativism, or EPOR.

1. The interpretative flexibility of scientific findings is presented; in other words, it is shown that scientific findings are open to more than one interpretation.
2. The social mechanisms that bind the interpretative flexibility, allowing the scientific controversies to be terminated, are described.
3. The relation of these "closure mechanisms" to the wider social-cultural milieu is analysed.

“If all three stages were to be addressed in a single study, as Collins writes, "the impact of society on knowledge `produced' at the laboratory bench would then have been followed through in the hardest possible case" (Collins 1981d, p7)” (Bijker, Hughes & Pinch., 1987, p27).

Pinch and Bijker then describe the differences between EPOR and SCOT beginning with the developmental process of a technological artefact. It is expressed as an “alternation of variation and selection”. This, they argue, moves the development from a linear path, to one that is multidirectional, an essential element to a social constructivist account of technology. Historical hindsight allows researchers to “collapse the multidirectional model on to a simpler linear model; but this misses the thrust of our argument that the "successful" stages in the development are not the only possible ones” (Bijker, Hughes & Pinch., 1987, p22). They also point out that SCOT is not a mould where data should be manipulated to fit into, as it has been built from a number of case studies and not from any untainted philosophical or theoretical analysis. “Its function is primarily heuristic to bring out all the aspects relevant to our purposes. This is not to say that there are no explanatory and theoretical aims, analogous to the different stages of the EPOR” (Bijker, 1984). The model highlights its multidirectional character and emphasises the interpretative flexibility of technological artefacts, as well as the role that different closure mechanisms may perform in the stabilisation of the artefacts. (Bijker, Hughes & Pinch., 1987, p29)

Table 1 Standard and Constructivist Images of Technology

Standard view of technology (and society)	Constructivist view of technology (and society)
Clear distinctions between the political and the technical domain	Both domains are intertwined; what is defined as a technical or as a political problem will depend on the particular context
Difference between 'real science' and 'trans-science'*	All science is value-laden and may—again depending on the context—have implications for regulation and policy; thus there is no fundamental difference between 'real science' and 'trans-science', 'mandated science', or 'policy-relevant science'
Social responsibility of scientists and technologists is a key issue	Development of science and technology is a social process rather than a chain of individual decisions; political and ethical issues related to science therefore cannot be reduced to the question of social responsibility of scientists and technologists
Technology develops linearly, e.g. *conception –> invention –> innovation -> diffusion*	Technology development cannot be conceptualized as a process with separate stages, let alone a linear one
Distinction between technology's development and its effects	The social construction of technology is a process that also continues into what is commonly called its 'diffusion stage'; the (social, economic, ecological, cultural, …) effects of technology are thus part of the construction process and typically have direct *vice versa* implications for technology's shaping
Clear distinction between technology development and control	Technology does not have the context-independent status that is necessary to hope for a separation of its development and control; its social construction and the (political, democratic) control are part of the same process
Clear distinction between technology stimulation and regulation	Stimulation and regulation may be distinguishable goals, but will often interfere with each other and need not necessarily be implemented separately
Technology determines society, not the other way around	Social shaping of technology and technical building of society are two sides of the same coin
Technology is an exogenous variable in neo-classical economics	Technology is an endogenous variable in evolutionary economics
Social needs as well as social and environmental costs can be established unambiguously	Needs and costs of various kinds are also socially constructed—depending on the context, they are different for different relevant social groups, varying with perspective

*The concept 'trans-science' was introduced by Weinberg (1972).

Figure 3.3.9a Standard and Constructivist Images of Technology (Bijker, 2004, p374)

3.3.10 SCOT Core Concepts

Interpretative Flexibility is, as with EPOR, the first stage of the model. Each technological artefact has different meanings and interpretations for various groups. Bijker and Pinch's bike example is used to describe the story. They explain that the development of the air-filled (pneumatic) tyre of the bicycle meant a more convenient mode of transportation for some people, whereas it meant technical nuisances, traction problems and was aesthetically challenged to others. Sport cyclists were concerned by the speed reduction caused by the tyre. These alternative interpretations generate different problems to be solved. Aesthetics, convenience or speed should be prioritised? What is the best trade-off between traction and speed? This has an important issue; not only is there flexibility in how people think of or

interpret the artefacts, but also that there is flexibility in how artefacts are designed. There is not just one possible or best way of designing an artefact.

The second stage of the EPOR concerns the mapping of mechanisms for the closure of the debate. In SCOT, it is for the stabilisation of an artefact. Closure in technology involves the stabilisation of an artefact and the removal of any problems. Bijker and Pinch illustrate what is meant by a closure mechanism by giving examples of two types that seem to have played a role in case studies. The key point in Rhetorical Closure is that the closure of a technological "controversy," need not actually solve the problem. It only requires the relevant social groups to see that the problem has been solved. It is argued that advertising can assist in such a process.

However, Closure by Redefinition of the Problem is much more complicated, in that it solves one problem, by inventing another, which is then solved. This is best described by example and, again, Bijker and Pinch's bike issue is utilised. The three main groups had very different issues with the pneumatic tyre development. The engineers thought it was a "theoretical and practical monstrosity", the general public felt it was an aesthetically awful accessory. Dunlop, and the other leading proponents of the tyre however, originally saw it as a solution to the vibration problem. The group of sporting high-wheeler cyclists riding did not accept that as vibrations were only a problem for the (potential) users of the low-wheeled bicycle. This meant that three important social groups were against the development of the tyre. Then, it was tested, on a racing bicycle at the racing track, too much hilarity. "This was, however, quickly silenced by the high speed achieved, and there was only astonishment left when it outpaced all rivals (Croon 1939). Soon handicappers had to give racing cyclists on high-wheelers a considerable start if riders on air-tire low-wheelers were entered. After a short period no racer of any pretensions troubled to compete on anything else (Grew 1921)" (Bijker, Hughes & Pinch., 1987, p45). The important question of 'so what' needs to be asked here. Well, for two of the important groups, the sporting cyclists and the general public, closure had been reached. However, it was not done by convincing those two groups of the feasibility of tyre as an anti-vibration device. It was, according to Bijker and Pinch, (1985) the meaning of tyre was changed to form a solution to another problem: the problem of speed (Bijker and Pinch, 1985). This ignores the third group, the engineers, who, were convinced by other, undetermined reasons in the paper.

"Of course, there is nothing "natural" or logically necessary about this form of closure. It could be argued that speed is not the most important characteristic of the bicycle or that existing cycle races were not appropriate tests of a cycle's "real" speed (after all, the idealized world of the race track may not match everyday road conditions, any more than the

Formula-1 racing car bears on the performance requirements of the average family sedan)" (Bijker, Hughes & Pinch., 1987, p46). They go on to state that racing is a form of testing, playing an important part in the development of such artefacts.

Closure, however, is not permanent. New social groups form and the process of introducing interpretative flexibility begins again, "causing a new round of debate or conflict about a technology. (For instance, in the 1890s automobiles were seen as the "green" alternative, a cleaner environmentally-friendly technology, to horse-powered vehicles; by the 1960s, new social groups had introduced new interpretations about the environmental effects of the automobile)" (Bijker, Hughes & Pinch., 1987, p46).

3.3.11 The Wider Context

Finally, Bijker and Pinch arrive at the third stage of their research programme. The mission in the area of technology appeared to match that for science; "to relate the content of a technological artefact to the wider socio-political milieu" (1987, p46). They argued that had yet to occur in sociological studies of the time. They are convinced that SCOT is the approach to take in such circumstances. "Obviously, the sociocultural and political situation of a social group shapes its norms and values, which in turn influence the meaning given to an artefact...SCOT's descriptive model seems to offer an operationalization of the relationship between the wider milieu and the actual content of technology" (Bijker, Hughes & Pinch., 1987, p 46).

In their final conclusion, Bijker and Pinch state their belief that a distinction between science and technology is not helpful when dealing with complex social outcomes; "it seems worthwhile to start with common-sense notions of science and technology and to study them in an integrated way, as we have proposed. Whatever interesting differences may exist will gain contrast within such a program. This would constitute another concrete result of the integrated study of the social construction of facts and artefacts" (Bijker, Hughes & Pinch., 1987, p47).

3.3.12 Technological Frames

Given the problems of SMEs and their somewhat unpredictable relationships and experiences with IT suppliers, there is a need to gain a better understanding of perspectives of all the stakeholders involved. In this case the stakeholders are made up of the key actors involved in the IT acquisition and implementation process. In SMEs this can involve mainly the owner managers or directors of the company together with IT technologists (sales and applications developers) from the IT supplier. A structured means of gathering and

understanding these diverse and multiple perspectives can be beneficial to maintaining and developing relationships between the stakeholders within the IT acquisition and adoption process. Orlikowski and Gash (1994) recognised the seriousness of this problem in their study of the adoption of groupware technologies in organizations. Based on a review of the literature, they developed a socio-cognitive approach that led to the development of a conceptual framework for examining the interpretations that people develop around technology. Two primary groups were identified as having significantly different technological frames; technologists and users. These differences of perspectives could lead to incongruences where different mental models affect the outcomes of technology adoption and use. Orlikowski and Gash (1994, p 178) define the term technological frame "to identify that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes not only the nature and role of technology itself, but the specific conditions, applications and consequences of that technology in particular contexts". Furthermore, Orlikowski and Gash (1994, p183) advocate using the concept of technological frames to detect levels of congruence within organizations across three distinct domains:

1. *Nature of Technology* – refers to people's images of the technology and their understanding of its capabilities and functionality.
2. *Technology Strategy* – refers to people's views of why their organization acquired and implemented the technology. It includes their understanding of the motivation or vision behind the adoption decision and its likely value to the organization.
3. *Technology in use* – refers to people's understanding of how the technology will be used on a day to day basis and the likely or actual conditions and consequences associated with such use.

Other researchers have used the concept of technological frames to investigate the differences in meanings that users, managers and technologists apply to IT projects. This ranges from: studies of the requirements determination process and the role of interpretive power (Davidson, 2002), analysing the important technological and social factors that lead to effective groupware adoption (Bjørn, Scupola & Fitzgerald, 2006), identifying key social and political factors that can change over time and be altered by context in the adoption of email systems (Lin & Silva, 2005), and also the examination of how technological framing can influence work redesign, development of new roles and practices within professional communities (Davis & Hufnagel, 2007).

It can be seen that the technological frames concept and approach can provide a level of interpretative analysis that may enable a better understanding of how to manage complex client and IT vendor relationships. This is particularly sensitive during the requirements elicitation process for COTS selection where high value investment decisions are being

made with many political, technical and social pressures. These pressures are evident from both sides of the client and IT vendor 'fence'. This research study adopts the technological frames approach, from Orlikowski and Gash (1994), to make sense of the sometimes incongruent and conflicting perspectives influencing the conduct and outcome of the electronic document control and management information system.

TABLE 1
Categories of Frame Domains Used in Technological Frames of Reference (TFR) Studies

Generic Frame Categories	*Frame Domains Identified in TFR Studies*
Frames related to information technology (IT) features or attributes	IT capabilities and design (Davidson, 2002); Nature of technology (McGovern & Hicks, 2004; Orlikowski & Gash, 1994; Shaw, Lee-Partridge, & Ang, 1997); Nature of user-centered systems development (Iivari & Abrahamsson, 2002); Requirements (Lin & Silva, 2005); Solution to the problem (Lin & Silva, 2005); The nature of problems (Lin & Cornford, 2000); Understanding of the problem (Lin & Silva, 2005); View of technology (Yoshioka, Yates, & Orlikowski, 2002)
Frames related to potential organizational applications of IT	Business value of IT (Davidson, 2002); Motivation and criteria for success (Iivari & Abrahamsson, 2002); Nature of technological change (Barrett, 1999); Rationale for technology (Yoshioka et al., 2002); Requirements for the system (Lin & Cornford, 2000); Technology strategy (McGovern & Hicks, 2004; Orlikowski & Gash, 1994; Shaw et al., 1997)
Frames related to incorporating IT into work practices	Issues around use (Lin & Cornford, 2000); IT-enabled work practices (Davidson, 2002); Nature of business transactions (Barrett, 1999); Technology-in-use (McGovern & Hicks, 2004; Orlikowski & Gash, 1994; Shaw et al., 1997); Use of technology (Yoshioka et al., 2002); Use of user-centered systems development (Iivari & Abrahamsson, 2002)
Frames related to developing IT applications in organizations	Business value of systems development (Ovaska, Rossi, & Smolander, 2005); Images of implementation (Lin & Cornford, 2000); IT delivery strategies (Davidson, 2002); Systems development capability (Ovaska et al., 2005); Systems development resource allocation (Ovaska et al., 2005); Systems development strategy (Ovaska et al., 2005); Type of partnership (McGovern & Hicks, 2004); Understanding of the project (Lin & Silva, 2005)
Other frame categories	Importance of market institutions (Barrett, 1999); Ownership of technology (Shaw et al., 1997); Vision of reskilling/type of change (Gallivan, 2001)
Unidimensional, social frame	Frame in the social construction of technology sense (Khoo, 2001; McLoughlin, Badham, & Couchman, 2000)

Figure 3.3.12a – Categories of frames (Orlikowski and Gash, 1994)

3.3.13 Social Constructionism and Technical Frames

Geels (2004) described four contributions to sectoral systems of innovation approach. His first was to unequivocally integrate the user viewpoint and he suggested that widening the analysis from only sectoral systems of innovation to embrace socio-technical systems.

These encompass the production, distribution and use of technology. The second contribution involved creating analytical distinctions between socio-technical systems, system actors and institutions and rules. This was an unusual step, as the prevalent approach to technology tends to emphasise 'seamless webs', away from boundaries and empirical reality. He argued that the complexity of reality allows these distinctions to be defined in order to analyse the interactions between these defined areas. A third contribution was to unwrap the "black box of institutions and provide a dynamic sociological conceptualisation which understands human action as structured, but leaves much room for intelligent perception and strategic action" (Geels, 2004, pp 915). This point of view, Geels argued, is useful as it allows the analysis to be done in the long-term, over years, decades, etc... This would mean that the emergence of new technologies, development of new user practices and changes in representation could be experienced and catalogued over a long time.

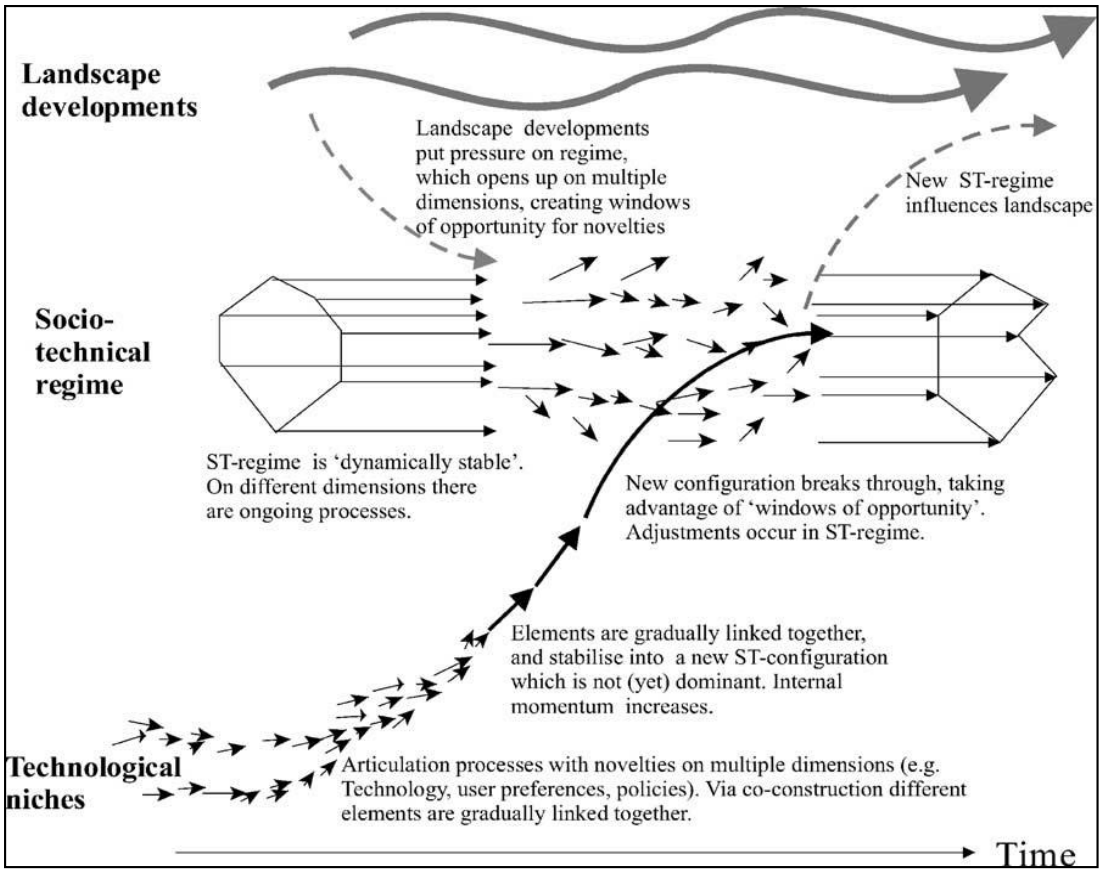

Figure 3.3.13a - A dynamic multi-level perspective on system innovations (Geels, 2004, pp 915)

His fourth contribution was to address the issue of change from one system to another. This involved describing a multi-level perspective, as shown in Figure 3.3.13a. This addressed socio-technical change at three levels. Any alterations appear when activities on these three levels connect and strengthen each other.

> *"This understanding of transitions is not only academically interesting, but also has societal relevance. Modern societies face several structural problems. Examples of these problems can be found in many sectors. The transport sector suffers from problems such as congestion, CO2 emissions, air-pollution (small particles: NOx). The energy sector suffers from problems such as CO2 and NOx emissions and reliability issues (oil). The agricultural and food sectors suffer from problems such as infectious disease (e.g. BSE, chicken plague, foot and mouth), too much manure, too much subsidies. These problems are deeply rooted in societal structures and activities."*

(Geels, 2004, pp 916)

Geels states that the conceptual perspective fairly complex, asking "can it be made operational for empirical research?" (Geels, 2004, pp 916) He gives examples of its use:

- The analysis of the transition from sailing ships to steamships. (Geels, 2002)
- The transition from horse-and-carriage to automobiles and from propeller-aircraft to turbojets. (Geels, 2002).
- The ongoing transition in Switzerland (1970–2000) from industrialised agriculture to organic farming and integrated production. Belz (2004).
- The failure of two niches in the Netherlands, manure digestion and heat pumps, because of mis-matches with regime-rules of electricity and agriculture. Raven and Verbong (2004)
- The niche-regime-landscape concepts to analyse the shift from computing regimes (based on punched-cards machines) to computer regimes. Van den Ende and Kemp (1999)
- The transition in the transhipment of grain in the port of Rotterdam (1880–1910), where elevators replaced manual (un)loading of ships. Van Driel and Schot (2004)
- The niches of manure digestion and co-combustion in the electricity regime. Raven (2004)

Geels argues that although these studies prove the applicability and usefulness of the theory, they highlight a need to differentiate the multi-level perspective in order to accommodate differences between sectors and industries. These mainly involve e time and pace issues i.e. rapid breakthrough, where sudden changes in the landscape level (e.g. war) create major changes in the selection environment of the regime where windows of opportunity for innovation are created and the technology breaks out of its 'traditional' niche to surprise incumbent niche firms e.g. the breakthrough of jet engines in and after World War II.

This route, along with other variations on the theme, shows a possible way forward and indicates that the multi-level systems of innovation approach useful and adaptable, much like the social climate humans have created.

3.4 Application to the Study

The understanding of EPOR and SCOT are fundamental in this study. SCOT in particular give the researcher guidance on what types of issues have been recorded previously when technology is adopted. By using Technological Frames, the researcher was able to frame the key points and aid the potential for repeatability of this type of study in other SMEs going through this type of project.

They also led to the use of Social Constructionism, the researcher's adopted stance for this project. It allowed the use of language to be investigated to glean some context to the project and study by asking the simplest questions and analysing the responses during the evaluation questionnaires.

3.5 Summary

In this chapter, the study has been concerned with outlining the theoretical framework upon which this project hangs. The researcher began by highlighting the issues surrounding the differing mind-sets around research from the built environment and information system's viewpoints. He observed that, although the project was based in a construction company, it was an IS adoption within an SME. From here, the discussion revolved around some alternative models for studying such projects, both formal and informal. The majority of the chapter looked at an integrated constructionist approach to the empirical study of science and technology and reviewed several relevant bodies of literature and strands of argument. The researcher indicated that the social constructionist approach showed every promise of wider application, specifically in the study of SMEs. It was argued that positivist, prescriptive innovation studies and much of the history of technology are unsuitable for our sociological purposes.

The researcher then outlined in more detail the two approaches- EPOR and SCOT, in which was based our integrated perspective and that of the concepts of interpretative flexibility and closure mechanism, which can be given empirical reference in the social study of technology.

As noted throughout the chapter, the sociology of technology is still underdeveloped when discussion technology, but when combined with a Technological Frames perspective, the framework takes on a new focused purpose. Throughout the study, the researcher proved that it is worthwhile to start with common-sense notions of technology and to study them in an integrated way, as proposed.

4 Methodology

4.1 Introduction

This chapter will discuss the research process. The processes used in the project initially appear random. However, the researcher had gained an understanding of the main research method, Action Research (AR), before any field work was undertaken and this chapter will describe and critically investigate the topic. From this, the project developed and required an additional, complimentary set of theories with which to describe the actions and outcomes that were being observed. These tools are described in the sections on the use of Mode 2 research and Bricolage.

> *I never guess. It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts.*
>
> (Sir Arthur Conan Doyle)

4.2 The Research Process

There are various methods and methodologies available to researchers. Often, they are not well arranged and can be confusing, especially when using terminology. There is a distinct lack of cohesion between texts on the subjects of methodologies, often based upon the authors' own experiences and bias. Indeed, "one frequently finds the same term used in a number of different, even contradictory, ways" (Crotty, 1998, p1) In order to manage this difficulty, the researcher has limited himself to a few authors who describe methodologies and methods consistently.

Crotty (1998, p2) breaks down the research process into four elements:

1. What methods will the research team use?
2. What methodology rules the choice and use of methods?
3. What theoretical perspective does the methodology rest upon?
4. What epistemology advises the theoretical perspective?

Research is often discussed using one or more of these terms, or their equivalents, in a "grab-bag style as if they were all comparable terms" (Crotty, 1998, p3). In this chapter, the researcher will simplify the terminology usage by limiting the amount of terms to an absolute minimum. Another complication when discussing methodological use comes from the design of the project from other influences.

In order to meet both the academic and industrial sponsor's expectations of the research project, it was necessary to adopt an adaptable methodological approach. However an

obvious danger with this tactic is that of distraction and a lack of focus, leading to an end product not conducive with the requirements of a Research thesis. The primary academic criterion was the creation of a Management Information System Model for Construction SMEs with a view to implementing ICT solutions. To accomplish this, a number of objectives were identified as integral to the project. These include the formulation of a model that outlines business processes in Construction SMEs and a review of current SME business process models in both the construction and other industries. The outputs from this project include the effective dissemination and adaption of current innovative and technical work for large organisations down to the level of most construction sector SMEs and the publication of refereed, academic papers in order to disseminate key findings to academic audiences.

These objectives and outputs are augmented by more 'industry-based' goals including the need to model and test the derived processes in the workplace. Further validation of the project was carried out using semi-structured questionnaires delivered by the researcher. The results of these lead to the publication of refereed, academic papers, in order to disseminate the key findings to industry practitioner audiences.

This project was a CASE funded ESPRC project, meaning there were prerequisite conditions from the study's organisation. It was agreed that this endeavour would seek to create significant financial benefits in terms of efficiency gains from enhanced ICT systems capability, new marketing opportunities and development of competencies through organisational learning.

This industrial criterion, along with the reasoning behind the sponsor's project initiation meant that the work had to make a significant contribution to the performance of the company, implying a mainstream agenda, rather than that of a more theoretical basis. It also meant that the study could not be in isolation to the company's day-to-day operation and be a supplementary student project.

Another influencing factor to the chosen methodological approach adopted was that the research was performed within the live business environment of the sponsor. This has led to a certain amount of commercial pressure exerted on the research, specifically involving timeliness as commercial organisations need to turn projects around quickly to demonstrate progress and deliver change. This commercial pressure added other dimensions to the researcher's approach to the methodology and three main researcher roles were defined; passive/listener, advisor and leader. These roles were critical to the project and are discussed later in the thesis.

The final methodological driver was the researcher and his epistemological stance. Until the project, it was not something he was aware of in academic terms but did understand that his own ‘bias’ taints his work, opinions and interests. The three main epistemologies listed by Crotty (1998) are Objectivism, Constructionism and Subjectivism.

These epistemologies lead us to the theoretical perspective, which in turn derives a methodology. It is only then that the actual method of study can be identified. However, as with all things ‘black or white’, grey usually appears in that a mix of methods, methodologies and theoretical perspectives can be undertaken. There seems to be no set rule to the mix but some combinations work together better than others, depending upon the investigative situation. The main issue the researcher had with these were that there seemed to be no way to have a little of all these views, depending upon what the discussion was at a specific moment in time; they seemed very ‘black or white’ in their roots.

The figure on the following page shows some of the available epistemologies, theoretical perspectives, methodologies and methods available to the researcher. The blue highlighted boxes represent those utilised for this study.

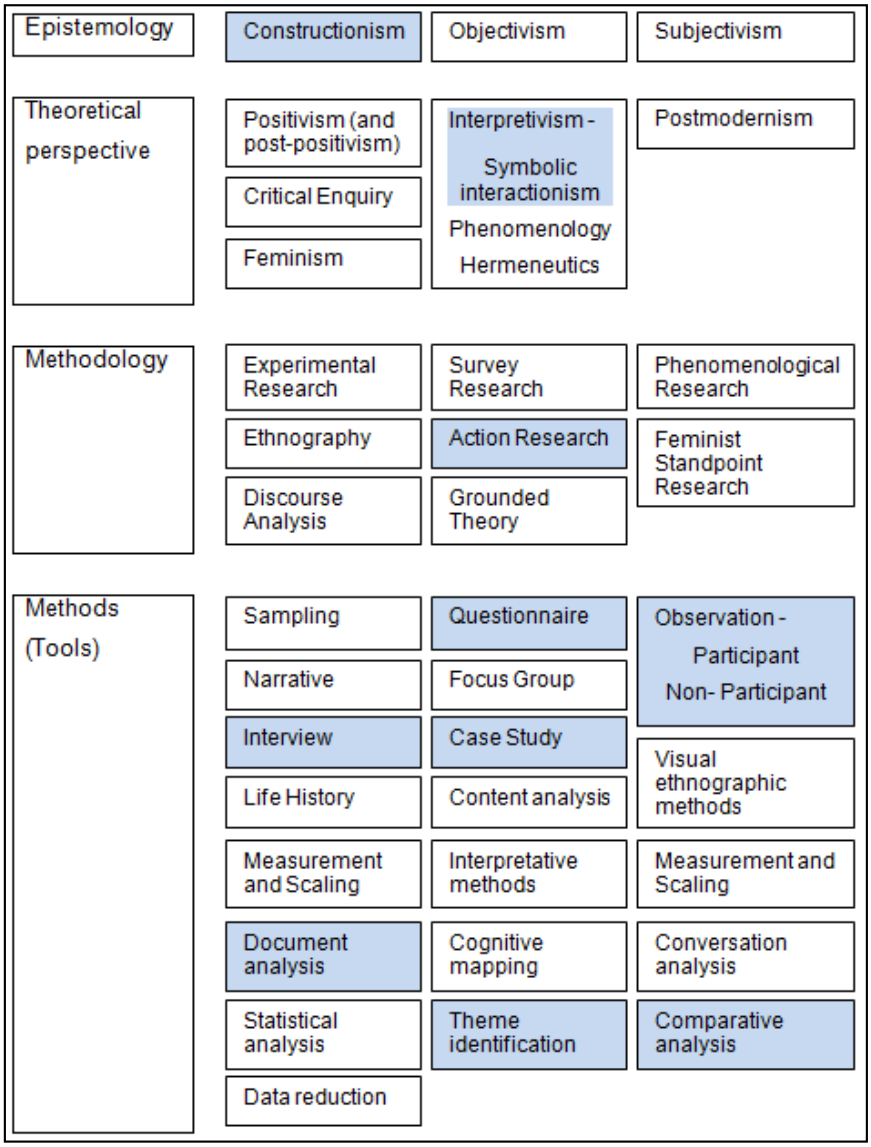

Figure 4.2a Epistemologies, Theoretical Perspectives, Methodologies and Methods

The section on Constructionism and its theoretical perspectives have been discussed previously. The tools used to feed the Methodology are discussed and utilised during the Case Study and subsequent chapters.

4.3 Methodology - Action Research

Action Research started out as an approach trying to find ways of eliminating the gap between theory and practice.

> *"We must find a way of bridging the traditional divide between educational theory and professional practice."*
>
> (Jack Whitehead quoted in NcNiff, 1988, pp ix)

Coghlan (2003) states that Action Research (AR) is a methodology based upon "a collaborative problem-solving relationship between researcher and client, which aims at both solving a problem and generating new knowledge." (pp452) This emphasises the strong relationship between the researcher and the practitioner.

> *It is fundamentally different from the research carried out in the laboratory where through the rigors of carefully defined variables and careful hypothesis testing researchers generate explanations and develop new theories.*
>
> (Curry, 2005, pp2)

Applied Research, as AR is often referred as, involves the community throughout the project and is often driven by an issue from the community itself. AR is a methodology which can be driven by a group of people requiring change whilst working with a researcher to focus on a solution to the problem.

Indeed, it actually "favours consensual and participatory procedures that enable people (a) to investigate systematically their problems and issues, (b) to formulate powerful and sophisticated accounts of their situations, and (c) to devise plans to deal with the problems at hand." (Curry, 2005, pp2). It actively takes

> *into account people's history, culture, interactional practices, and emotional lives…Action research is focused on problem solving through inquiry into human problems in a real context. It is fundamentally different from the research carried out in the laboratory where through the rigors of carefully defined variables and careful hypothesis testing researchers generate explanations and develop new theories... In contrast, action research, often called applied research, involves the community at all stages. In many cases, the research project has been prompted by a request from the community itself.*
>
> (Curry, 2005, pp2)

Just to add potential confusion to the definition of Action Research, practitioners

> *may use different terms to describe similar processes. Action Research is also referred to as participatory action research (PAR), participatory research, participatory evaluation, emancipatory action research, action science, action learning, action inquiry, mutual inquiry and empowerment evaluation.*
>
> (Whitehead, Taket & Smith, 2003, pp7)

However, within these definitions, AR and PAR, there are four basic themes: empowerment of participants; collaboration through participation; acquisition of knowledge; and social change.

4.3.1 The Origins and Development of Action Research

According to Masters (1995), the origins of Action Research are relatively unclear within the literature available.

> *"Authors such as Kemmis and McTaggert (1988), Zuber-Skerrit (1992), Holter and Schwartz-Barcott (1993) state that action research originated with Kurt Lewin, an American psychologist"*
>
> (Masters, 1995).

His work was introduced at the Research Centre for Group Dynamics in the University of Michigan, USA. (Curry, 2005) It is, however, a relatively new and controversial research design. The origins of AR go back to the 1940's according to Whitehead et al (2003). *"Lewin first coined the term action research in 1946"* (pp6). There is also some evidence of the use of a form of Action Research by a doctor called Moreno, who reportedly used group participation in 1913 for a community development initiative with prostitutes in Vienna, Austria (Masters, 1995).

Kurt Lewin stated that if research did not produce actual benefits, as well as literature was not useful, i.e. research should not be conducted for no reason. His opinion was that Social Practice research should be illustrated by results in social management or engineering. The kind of Action Research that would fulfil these aims would look at the conditions or environment in which they operated to enable comparison between the effects of implementing the research outcomes and monitoring the results. The creation of this Action Research theory by Lewin made it an acceptable method of inquiry.

Lewin's approach is either in the form of a circle or spiral of stages. The spiral, shown graphically in Figure 4.3.1a on the following page, includes planning, action and finding out about the results of implementing the said actions.

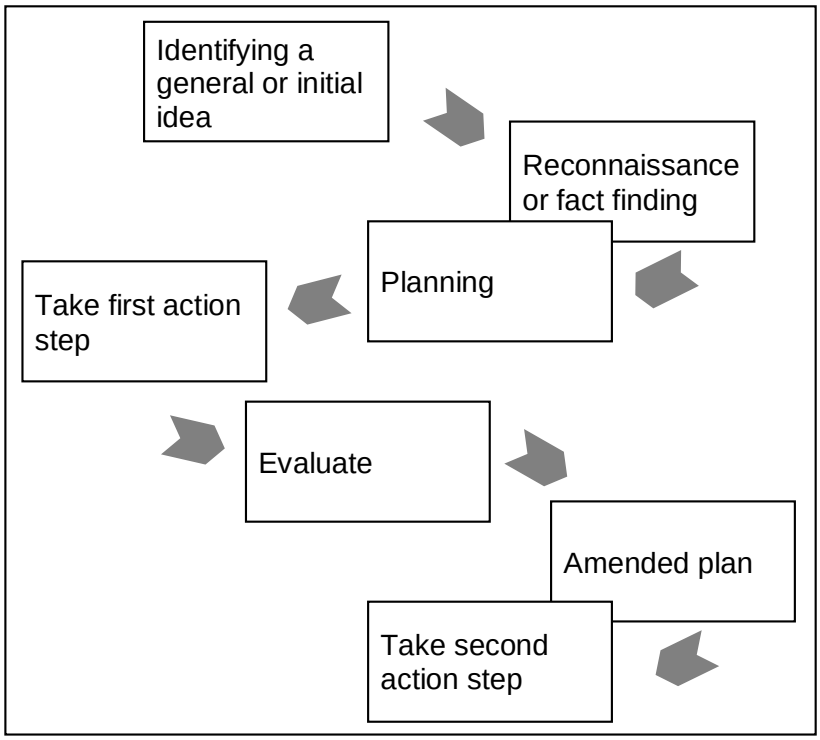

Figure 4.3.1a - Lewin's Action Research Spiral, Adapted from (Infed, 2007)

This spiral represents the key stages that Lewin identified to process Action Research. The very first stage of the spiral is the identification of an idea or problem. This often needs repeating as more facts are required to classify the situation. Once this is completed, Lewin argues that there are two outcomes; a plan of action and a decision of how to act.(Infed, 2007) The following stage encompasses planning, the execution and fact-finding that allows for an evaluation to take place. This leads on to either planning for the third stage or the adaptation of the whole plan. Again, Lewin argues that the plan is constantly evolving to match the situation it finds itself in, which corresponds with *"Dewey's conception of learning from experience"* (Infed, 2007). The model follows a fairly sequential form, which is open to unembellished elucidation and can lead to the notion of 'correctness' rather than 'goodness'.

However, Masters (1995) describes the same cycle in four distinct stages: planning, acting, observing and reflecting. Another approach is given by Curry (2005) who offers an even more basic form of the cycle, which is based upon work quoted from Stringer (1999) and Robson (2002).

> *The steps for carrying out action research differ from subject to subject, but the basic procedure is:*
>
> *First step – researchers observe the situation carefully, working with those at the research location to define and describe the problem to be investigated, along with a description of the environment or context of the problem situation*
>
> *Second step – participants (the researchers and the community) analyze and interpret the situation to deepen their understanding of the background and extent of*

> *the problem, and to identify as well other players who may be implicated. A general review of the literature may be carried out at this step*
>
> *Third step – participants plan an action that will lead to resolving the problem, carry out the action, and evaluate the results to assess whether the action led to the resolution of the problem.*
>
> (Curry, 2005, pp2)

4.3.2 Action Research; some approaches

The literature clearly shows a split of AR into two distinct camps; The UK camp and the USA camp. The UK convention is mostly linked to education or healthcare and views it as research driving the enhancement of direct practice.

> *Action research is simply a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out*
>
> (Carr & Kemmis, 1986, pp162)

This is a popular description, as it places the main emphasis on the practitioner and goes with the current notion of self-reflection.

The second major convention is described as *"the systematic collection of information that is designed to bring about social change"* by Bogdan and Biklen (1992, pp223). This convention is more routed in the social welfare area, specifically in the United States of America. Bogdan and Biklen (1992) argue that practitioners gather evidence or records to depict negative issues in order to make recommendations for change. Indeed, AR is seen as a throwback to the days of citizen's action and community organising, where the *"practitioner is actively involved in the cause for which the research is conducted. For others, it is such commitment is a necessary part of being a practitioner or member of a community of practice"* (Bogdan & Biklen, 1992, pp223). The following figure summarises the 'American', community based view of Action Research

Community-based Action Research

A fundamental premise of community-based action research is that it commences with an interest in the problems of a group, a community, or an organization. Its purpose is to assist people in extending their understanding of their situation and thus resolving problems that confront them.…

Community-based action research is always enacted through an explicit set of social values. In modern, democratic social contexts, it is seen as a process of inquiry that has the following characteristics:

It is democratic, enabling the participation of all people.

It is equitable, acknowledging people's equality of worth.

It is liberating, providing freedom from oppressive, debilitating conditions.

It is life enhancing, enabling the expression of people's full human potential.

(Stringer, 1999, pp9-10)

The Action Research process

Action research works through three basic phases:

Look - building a picture and gathering information. When evaluating we define and describe the problem to be investigated and the context in which it is set. We also describe what all the participants (educators, group members, managers etc.) have been doing.

Think – interpreting and explaining. When evaluating we analyse and interpret the situation. We reflect on what participants have been doing. We look at areas of success and any deficiencies, issues or problems.

Act – resolving issues and problems. In evaluation we judge the worth, effectiveness, appropriateness, and outcomes of those activities. We act to formulate solutions to any problems.

(Stringer, 1999, pp 18, 43-44, 160)

Figure 4.3.2a - Stringer on Action Research, Adapted from (Infed, 2007)

This 'American' style of Action Research is further split, with some insisting that it must be collaborative and necessitate group work.

> *Action research is a form of collective self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of those practices and the situations in which the practices are carried out… The approach is only action research when it is collaborative, though it is important to realise that action research of the group is achieved through the critically examined action of individual group members.*
>
> (Infed, 2007)

The reasons for this insistence and other opinions are further explored by Masters (1995). She discusses three modes of action research: technical, practical (or mutual collaborative) and emancipatory (or enhancement) approaches. These can also be listed as a positivist perspective, an interpretivist perspective and a critical science perspective (Masters, 1995).

Philosophical Base	Technical Action Research	Mutual - Collaboration Action Research	Participatory Action Research
	Natural Sciences	Historical - hermeneutic	Critical Sciences
The nature of reality	Single, measurable, fragmental	Multiple, constructed, holistic	Social, economic. Exists with problems of equity and hegemony
Problem	Defined in advance	Defined in situation	Defined in the situation based on values clarification
Relationship between the Knower and Known	Separate	Interrelated, dialogic	Interrelated, embedded in society
Focus of collaboration theory	Technical validation, refinement, deduction	Mutual understanding, new theory, inductive	Mutual emancipation, validation, refinement, new theory, inductive, deductive
Type of knowledge produced	Predictive	Descriptive	Predictive, descriptive
Change duration	Short lived	Longer lasting, dependent on individuals	Social change, emancipation
The nature of understanding	Events explained in terms of real causes and simultaneous effects	Events are understood through active mental work, interactions with external context, transactions between one's mental work and external context	Events are understood in terms of social and economic hindrances to true equity
The role of value in research	Value free	Value bounded	Related to values of equity
Purpose of research	Discovery of laws underlying reality	Understand what occurs and the meaning people make of phenomena	Uncover and understand what constrains equity and supports hegemony to free oneself of false consciousness and change practice toward more equity

Figure 4.3.2b - The Three Types of Action Research, Adapted from Masters (1995)

Grundy (1982) noted a similar view and argues that the three modes of action research do not differ in methodologies but in the core assumptions and views of the participants. They are creating the discrepancies in the methodology's application with the researcher's assistance. Grundy emphasises the participant's relationship as an impact on the overall outcome.

> *The differences in the relationship between the participants and the source and scope of the guiding 'idea' can be traced to a question of power. In technical action research it is the 'idea' which is the source of power for action and since the 'idea' often resides with the facilitator, it is the facilitator who controls power in the project. In practical action research power is shared between a group of equal participants, but the emphasis is upon individual power for action. Power in emancipatory action*

> *research resides wholly within the group, not with the facilitator and not with the individuals within the group. It is often the change in power relationships within a group that causes a shift from one mode to another.*
>
> (Grundy, 1982, pp363)

According to Coghlan and Shani (2005), Action Research cannot be classified as one single methodology as it includes a wide and varied range approaches, activities and methods. The authors describe them as complex dynamics, initiated by the design of the collaborative effort. AR is viewed as a holistic process where strategic or policy choices are focused on *"simultaneous action and research in a collaborative manner, design requirements that can make the policy choices operational, and design dimensions that bound and specify the requirements and lead to a realized design"* (Coghlan & Shani, 2005, pp534). These dimensions lay down the framework within which the AR endeavour progresses.

These differences in how the methodology is described do not prevent writers in the field from creating 'standard templates' upon which to make research methodology decisions. Denscombe (1998) proposes a checklist to ensure that the decision to use AR is appropriate.

Checklist for Action Research	
1	Does the research project address a concrete issue or practical problem?
2	Is there participation by the practitioner in all stages of the researcher project?
3	Have the grounds for the partnership between practitioner and any outside expert been explicitly negotiated and agreed?
4	Is the research part of a continuous cycle of development (rather than a one-off project)?
5	Is there a clear view of how the research findings will feedback directly into practice?
6	Is it clear which kind of action research is being used – 'technical', practical' or 'emancipatory'?
7	Has insider knowledge been acknowledged as having disadvantages as well as advantages for the research?
8	Is the research sufficiently small-scale to be combined with a routine workload?
9	Have ethical matters been taken into consideration?

Figure 4.3.2c - Action Research Checklist., (Denscombe, 1998, pp67)

4.3.3 Implementation

It is not possible to implement anything without people, meaning the researcher is faced with the matter of 'role' at the very beginning of the study (Coghlan & Shani, 2005). These roles

"are patterns of behavior which individuals expect of others performing specific functions or tasks. Katz and Kahn (1978) describe organizations as a system of roles" (Coghlan & Shani, 2005, pp353). A four-way split of these roles can be made:

> *Role expectations are the evaluative standards that are applied to the behavior of the focal person who occupies a given organizational role. They represent the cognitions and motivations of the role senders.*
>
> *Person sent-role consists of the communications arising from role expectations and sent to the focal person to influence behavior. They represent the behaviors of the role senders.*
>
> *Received role is the perceptions of the sent-role, including expectations that the focal person himself/herself creates. They represent the cognitions and motivations of the focal person.*
>
> *Role behavior is the response of the focal person to the information and influence received. They represent the behaviors of the focal*
>
> (Coghlan & Shani, 2005, pp353).

The model that the four roles fit includes organizational, personality and interpersonal factors. In Action Research, the organizational factors can relate to size, intricacy, climate, culture, readiness and capacity for change, etc., all of which wield influence on the Action Research course of action. The personality factors refer to the researcher's perception, motivations and skills, and interpersonal factors are those between the role dispatcher and researcher, which can influence the role behaviour of both parties. (Coghlan & Shani, 2005, pp535)

4.3.4 The Process of Change

Once the decision is made to move forward with an Action Research study, the implementation process begins. Coghlan and Brannick (2001, pp85) compared it to making a movie. *"Actor-directors go with the story…they also create and follow a script"*. A framework for change is discussed in four distinct phases:

- Determining the need for change and the degree of choice.
- Defining the future state, after the change has taken place.
- Assessing the present in terms of the future to determine the work to be done.
- Managing the transition state.

(Coghlan & Brannick, 2001, pp86)

4.3.5 The need for change

There are two main elements in evaluating the need for change (Coghlan & Brannick, 2001). The first is identification of the need, the naming, and the causes that have brought it about,

why. These are critical as it is necessary to classify the change required. Externally driven change from customer demand, legislation, etc. or internally driven change, from staff morale issues, budget over-runs, etc. need to be viewed as quickly and critically as possible. (Coghlan & Brannick, 2001)

4.3.6 The desired future

When the need for change has been identified, a definition is required of the targeted end result and outcomes of the change. An agreement is needed with the stakeholders for a consensus view about what the change will finally look or be. It allows the process to be focused and full of energy as it should illustrate the future in a positive light (Coghlan & Brannick, 2001, pp87)

4.3.7 Assessment of the present

Once the future direction and destinations has been identified, the present conditions are required. The assessment of the present situation permits a map of the course to be drawn and allows all those affected by the change to know what, and who, will need to be changed, moved, renewed or removed. The questions of how and when can also be addressed at this time (Coghlan & Brannick, 2001, pp 87).

4.3.8 The transition

"This step is what is generally perceived as being the actual change process…" (Coghlan & Brannick, 2001, pp88). This transition period links the present (soon to be the past) with the future. It is traditionally a difficult time for all stakeholders as the new state has not yet appeared but the situation being replaced is no longer valid. Two characteristics of management will help remove the general discombobulation; a plan, with goals, structures, etc. and commitment, with responsibilities and involvement.

4.3.9 Reviewing and Learning

AR, as a methodology, needs to go through the same continuous improvements as it advocates in order to keep changing positively (to not lose its thrust).

4.3.10 Data Generation as Intervention

The researcher is acting as an agent of change during a study of Action Research. This makes the study susceptible to bias. Access to a considerably large body of data is usually gained; often more than he or she can handle (Kock, 2004). The issue is that this body of data is usually 'broad and shallow'.

An issue in Action Research is that the vast body of this shallow data is often difficult to analyse due to its rich context. Further on, this data is often associated with a difficult analysis, becoming cumbersome and interfering with the progress of the study. (Kock, 2004)

4.3.11 Knowing when to stop.

While AR facilitates the emergence of theoretical models from the research data, it can also create problems (Kock, 2004). The environment being studied will often change, either in a predicted or an unpredicted way. Kock (2004, pp268) describes the change environment dilemma; *"the change may in some cases force the researcher to revisit his or her methods, theoretical assumptions, and even his or her research topic before a single iteration of the AR cycle is completed".* This could be a never-ending cycle.

> *"The research is complete, either when the identified problem is addressed or resolved to the satisfaction of everyone involved, or when those involved decide that it is prudent to do so"*
>
> (Whitehead, Taket & Smith, 2003, pp10)

One way that AR can be stopped is if an AR project employs control groups. Given Action Research's own definition, it can no longer be called AR, and should be seen as a field experiment. (Kock, 2004)

4.3.12 Limitations

While deep personal involvement from the part of the researcher has the potential to bias research results, it is inherent in AR because it is impossible for a researcher to both be in a detached position and at the same time exert positive intervention on the environment and subjects being studied. The practitioner may perceive events and situations with a high degree of personal involvement. Kock points out situations involving conflict, stress, or any events that may lead to an emotional response as a limitation of the methodology. The researcher can interpret gathered data in a subjective way, which could lead to an external bias can have negative impact on the study.

> *That is the ''externalization'' bias, whereby an individual has difficulty assigning blame for ''negative'' outcomes of his or her own actions (e.g., dissatisfaction or frustration by his or her peers) to himself, instead trying to find ways to explain those ''negative'' outcomes based on factors that are external to him or her.*
>
> (Kock, 2004, pp269).

Another limitation of Action Research has been noted by Kock (2004), who argues that the theoretical model of AR emerges from the research data, rather than being defined earlier and tested against that data. The practitioner also attempts to change the environment of the

study by using Action Research and rarely has full control over that environment, which can limit the outcome of the study.

4.3.13 The Application of AR in the Project

The application of AR in the project was planned to be participative. However, the researcher and his team could not fit the project into the model required. As described by Masters (1995), the project was not predictive, especially considering the main decision not to adopt and MIS. It was also difficult to extract any evidence of social change or issues around equity, mainly due to the lack of comparable cases.

The best AR fit belongs to that of collaboration AR, as described below.

Philosophical Base	Mutual - Collaboration Action Research Historical - hermeneutic
The nature of reality	Multiple, constructed, holistic
Problem	Defined in situation
Relationship between the Knower and Known	Interrelated, dialogic
Focus of collaboration theory	Mutual understanding, new theory, inductive
Type of knowledge produced	Descriptive
Change duration	Longer lasting, dependent on individuals
The nature of understanding	Events are understood through active mental work, interactions with external context, transactions between one's mental work and external context
The role of value in research	Value bounded
Purpose of research	Understand what occurs and the meaning people make of phenomena

Figure 4.3.13a - Action Research, Adapted from Masters (1995)

Due to the lack of any form of control by the research team over the project at key points, most of the study was defined by the situation, rather than influencing it. This has led to a descriptive study taken over a long period. The new aim of the study also reflects this approach as it now seeking to understand what happened during the project and what it means.

However, even this model is not an exact fit to the project. Due to the uniqueness of the project and study, it is not possible to draw from other replica projects and studies in this arena as required by the nature of understanding's external context. Any context used in this study is derived from alternative industries or experiences.

4.3.14 Mode 2 Research

In 1994, Gibbons, et al, published their view of the new trend in research. This had a very different motivation to the traditional, Mode 1 style of exploration.

'Mode 1' knowledge production	'Mode 2' knowledge production
Problems defined by academics and professional communities	Knowledge produced in context of application
Disciplinary knowledge	Transdisciplinary knowledge
Homogeneous sites/types of knowledge production	Diverse sites/types of knowledge production
Research as objective investigation	Research as reflexive/ dialogical
Quality control by 'invisible colleges'	New forms of quality control and required with social accountability

Figure 4.3.14a - Summary of Mode 1 and Mode 2 ((Swan *et al.*, 2010, p 1313)

MacLean, MacIntosh and Grant (2002) also discuss the comparisons between Mode 1 and Mode 2 research. Regarding Knowledge production, they state that both have "a range of methodologies which might be described as traditional or positivist science." (p 205) However, Mode 1 is not driven by the application's context, rather that of theoretical perspectives. These perspectives are focussed from one particular discipline, usually academic in nature, compared to Mode 2, where a team of people with differing disciplines and backgrounds are employed. They also state that

> *"given the prevalence of both theoretical and organizational homogeneity in mode 1, it is less likely to produce true social accountability. Also its preference for positivist approaches reduces the likelihood of reflexivity being a key feature of the knowledge production process, or at least the likelihood of this being an acknowledged feature of the research."*
>
> (MacLean, MacIntosh & Grant, 2002, p 205)

Research itself switches, from a completely objective study to one where reflexivity and social dialogue are facilitated throughout the research process. Finally, the control issue of the research is highlighted. Whereas Mode 2 is driven by the research problem, thus requiring a range of quality measures, Mode 1 has "a comparatively uniform approach to quality control. Outputs are generally evaluated from the standpoint of the particular discipline concerned and the evaluation itself is usually driven by senior academic peers." (MacLean, MacIntosh & Grant, 2002, p 205)

4.4 Methods

As the project progressed, the researcher discovered that he had to use the tools, or methods, at hand in order to create a feasible, robust, and accurate project structure. This form of study design is known as bricolage.

4.4.1 Bricolage

Utilising available resources to create new forms and order from tools and materials at hand has been defined by anthropologists as ‘bricolage’ (Strauss, 1966). The main feature of bricolage is that it builds up structured sets, not directly with other structured sets but by using the remains and debris of events: in French 'des bribes et des morceaux', or odds and ends in English. This fits very well with the researcher’s approach, as he had a legacy of other projects completed within the firm and the afore-mentioned commercial pressure, both of which provided a direction for the study. This meant that the overall scope for implementing change into the organisation was limited to the document management system and its adoption only. By strict definition, the bricoleur’s ‘universe of instruments’ is limited, and he will make use of whatever is to hand (Ferneley & Bell, 2006). In the case of this study, the researcher used the company’s existing technologies and the redesign of the new system to attempt to enhance the organisation’s communications.

“The ‘bricoleur’ is adept at performing a large number of diverse tasks; but, unlike the engineer, he does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project. His universe of instruments is closed and the rules of his game are always to make do with ‘whatever is at hand’, that is to say with a set of tools and materials which is always finite and is also heterogeneous because what it contains bears no relation to the current project, or indeed to any particular project, but is the contingent result of all the occasions there have been to renew or enrich the stock or to maintain it with the remains of previous constructions or destructions.” (Strauss, 1962, p11)

During the project the researcher had to use the methods that fitted the environment within which he worked. This toolkit utilised the following methods:

4.4.1.1 Case Study (incorporating some life history and narratives)

A case study is a story about something unique, special, or interesting—stories can be about individuals, organizations, processes, programs, neighbourhoods, institutions, and even events.(Yin, 2003) Case studies are often used in Action Research projects (Meyer, 2000). This is mainly due to the participative nature of the study. “A case study examines a

phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations).” (Benbasat, Goldstein & Mead, 1987, p370)

Case studies are not the only method available and it is useful to compare with others often used in IS research. For example, laboratory experiments are used to measure dependent variables while manipulating independent variables in a controlled, environment. Field experiments are similar, but used a natural setting. However, field studies measure independent and dependent variables in their natural context but do not attempt to control or manipulate any processes. “A fundamental difference between case studies and these alternative methods is that the case study researcher may have less a priori knowledge of what the variables of interest will be and how they will be measured.” (Benbasat, Goldstein & Mead, 1987, p370)

1	Phenomenon is examined in a natural setting.
2	Data are collected by multiple means.
3	One or few entities (person, group, or organization) are examined.
4	The complexity of the unit is studied intensively.
5	Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude towards exploration.
6	No experimental controls or manipulation are involved.
7	The investigator may not specify the set of independent and dependent variables in advance.
8	The results derived depend heavily on the integrative powers of the investigator.
9	Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.
10	Case research is useful in the study of "why" and "how" questions because these deal with operational links to be traced over time rather than with frequency or incidence.
11	The focus is on contemporary events.

Figure 4.4.1.1a - Key Characteristics of Case Studies (Benbasat, Goldstein & Mead, 1987, p371)

Action research findings have more meaning to practitioners as they “closely reflect reality by responding to events as they naturally occur in the field” (Meyer, 2000, p8). Justification for the suitability of the chosen research instrument is founded on Hill and McGowan’s (1999) work which suggests that small company research may be best done using a qualitative approach that includes participant observation, case studies, in-depth interviewing and the use of documentation.

4.4.1.2 Observation (participants and non-participants)

The very nature of case studies requires ‘entities’. As stated earlier, these could be people, groups or organisations. In this case, an organisation was investigated; through its adoption of a new IS system. This meant that there were both participants, actively involved in decisions, testing and adoption, and non-participants, who were considered during the project, but not actively involved throughout the process. These non-participants include the various suppliers and subcontractors of SMEcon who, although critical to SMEcon’s operations, did not have their own input to the system adoption.

4.4.1.3 Document Analysis

Document analysis can be very technical as it could delve into the “essential communicational structures of sentences, paragraphs and texts in terms of theme, rheme and thematic progression, connectors of clauses and sentences, and semantic progression”. It could also discuss the global structures of narrative and expository texts, describe the interaction of macro- and micro- structure in the interpretation of texts and the role of presupposed 'states of knowledge ' in both text production and text comprehension” (Hutchins, 1977, p17) However, for this study, document analysis is simply the study of appropriate documents used in SMEcon, as determined by NR. It is also used to extract the useful text, as transcribed from the interviews.

4.4.1.4 Questionnaires and Interviews

The researcher utilised a semi-structured questionnaire format in order to validate some of the findings gleaned from the case study itself. This was designed to question two main areas of the adoption; company issues and personal issues.

The company issues looked at the adoption process using Orlikowski and Gash’s Technological Frames. The term ‘technological frame’ is used “to identify that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations” (1994, p178). They go on to suggest that the conditions, application and outcomes of the technology in use are influenced by their context.

> *Early interpretations of a technology are particularly influential because they get established rapidly as the technology is assimilated into work practices and becomes built into organizational routines and work habits. By examining key actors' taken-for-granted’ notions of technology, we can gain much insight into how technologies are developed, used, and changed in organization.*
>
> (Orlikowski & Gash, 1994,p 179)

The personal issues questioned involved individual's compliance with the new system and it's 'rules'. This was split into two areas; resistance and workaround. The researcher hoped to identify what type of resistance, positive or negative, was in situ, as well as investigating the lengths that people went to in order to 'get around' the system i.e. the actions taken due to their resistance.

4.5 Project Timeline and Milestones

The following figure shows the key research milestones and the tools used during the project.

Time span	Description	Key decisions	Action Research	Research Tools
September 2006	This work entailed the design of the MIS structure in paper form. A published academic paper (Douglas et al., 2008), highlighted some of the issues encountered during this period.	Information Structure Ideas for the 'Golden Rules' for information storage	Cycle 1	Observation, Document analysis
December 2007	This month consisted of an independent report on the existing computer (hardware and software) in operation @ SMEcon. Meetings with SMEsup2 and SMEint	Decision to employ SMEsup2 Decision to employ SMEint	Cycle 2	Observation, Comparative analysis
March 2008	Work done on Version 2 of paperwork, to allow for Intranet-based Document Repository	Keeping documents in Office 2003.	Cycle 1 into Cycle 2	Observation
June 2008	Website Launch	New account manager at SMEint. Structure and wording of website confirmed	Cycle 2 and Cycle 3	Observation
July 2008	Intranet redesign and Launch	New 'structure' in intranet system. Phased launch of new system onto new SMEcon projects beginning from 7th	Cycle 3	Observation
September 2008	Major Intranet redesign due to user issues	Decision to re-launch Intranet ASAP	Cycle 3	Questionnaire, Observation,

				Comparative analysis
November 2008	Continuation of October 2008 work.	Switch all users' computer browsers due to unforeseen technical issues.	Cycle 3	Comparative analysis, Observation
January 2009	Training of site operatives and Handover of SMEcon's work to another researcher/SMEcon	Handover of SMEcon information	Cycle 3	Observation, document analysis, theme identification

Figure 4.5.1a - Key research milestones

The initial Cycle of the action research project involved the creation of the paper-based document system. The researcher used participant observation as the main method for this task. The iterations of the documents meant that this was a long and laborious series of tasks, with checking and re-checking the documents by both the researcher and NR.

Cycle 2, the IS system, was much shorter than the researcher planned, as NR made the procurement decision very quickly and without very much advice from the researcher. The researcher was asked by NR to lead the project from SMEcon's view, as his experience in managing IT suppliers was one of the resources now available to SMEcon.

Action Research Cycle 3 was very much in the form of Cycle 1, where the many iterations and checking made for another long process. However, it also provided the researcher with clear themes with which to create the questionnaire in order to interview SMEcon's employees after the project was complete.

4.6 Summary

This chapter discussed the research process constructed for this project. Due to the manner of the project's origins, some decisions had already been made as to its methods. Action Research (AR) was the defining methodology for the project to be progressed and it was this that underpinned the project's structure. AR is a dynamic methodology in that it allows the subject to be observed in ways that best suit the subject. This was an excellent method with which tom study and SME, as they are very dynamic themselves. However, the processes used in the project initially appear random but the researcher had gained an understanding of the main research method which allowed him to 'roll with the punches' as the project developed. As this occurred, an additional, complimentary set of theories with which to describe the actions and outcomes as they happened, were required. Mode 2 research and Bricolage were used extensively throughout the project, especially where unusual and unexpected events and effects took place. The fluidity that this mix of methods and

methodologies provided allowed the researcher to progress the project with the necessary variances that come with field-based project work.

5 Context and Case Study

5.1 Introduction

This chapter will provide a timeline and narrative of events that took place over the period of primary research within the company. In order to retain anonymity, the researcher has created pseudonyms for the protagonists.

For example, the name SMEcon has been adopted to retain the anonymity of the construction company involved in the research project whilst SMEsup1 represents the original ICT support company, SMEsup2 is the replacement ICT support company and SMEnet is the company contracted to create the Intranet and Internet system. Extracts from all of the company's former and current websites remain unreferenced for the same reason. The table below provides all of the pseudonyms used in this thesis.

Pseudonym	Brief description of duties
SMEcon	The Construction company forming the basis of the research
The researcher, AD	The author of this thesis
SMEsup1	Initial ICT support company
SMEsup2	Replacement ICT support company
DG	Professor David Greenwood, Lead Supervisor
DW	Professor David Wainwright, Supervisor
SMEnet	Intranet/Internet supply company
SMEnet contact 1	Initial contact from SMEnet
SMEnet contact 2	Replacement contact from SMEnet
HSE	Health, Safety and Environment
AD	The Researcher
NR	The Sponsoring Director/Commercial Director

Figure 5.1a - Pseudonyms used within this thesis (see Glossary)

5.2 Brief Background of the Construction Company

At the beginning of the research project, the construction company, SMEcon, had twenty employees (this varied slightly, depending upon size and volume of projects) with its head office in an industrial estate in the Northeast of England. The company provide "professional services to the construction and property industries … [and works] …. with individuals, companies and organisations, providing a complete service" [original website]. They originally conceived the 'Property Cycle' as being split into five phases; Develop, Design, Build, Maintain and Manage, and that each of these divisions could stand alone as a service

or be combined in a manner that suited the client. The three owner-directors of the company each had around 20 years' experience in the industry and they formerly operated as the regional management team of a major national construction and property company. They describe themselves as having "a wealth of experience in managing a successful regional business for a major multi-national organisation." However, "the team decided to rid itself of the shackles of the plc [their former company] to concentrate on using its skills and experience for the direct benefit for the people who really matter – employees and customers!" [text taken from SMEcon original website]. Their feeling was that large companies can't change quickly enough to suit client demands and other industry developments due to bureaucracy, complex reporting mechanisms and a "lack of direct contact' with the clients, suppliers and other stakeholders" [Interview with Commercial Director, 19/03/07].

The company's structure was based upon a framework that was introduced to the team in the late 1990s. This framework, along with their individual and group experiences, gave them a clear goal as to the direction the company would go along with a clear method of accomplishing this. They are committed to the 'change agendas' of Latham (1994) and Egan (1998), as well as other more recent developments, to adopt a new way of working within the construction industry. They feel that this should give them a real competitive advantage in the industry. [Interview with Commercial Director, 19/03/07]. These changes include the implementation of a co-ordinated project information system, quality-based tendering, committed leadership, a focus on the customer, integrated processes / teams, a quality driven agenda and commitment to people. The company policy is described as providing

"maximum value for money to customers by combining a relaxed, friendly and flexible approach with a wealth of experience, expertise and professionalism. Our approach is to work closely with our customers to fully understand their requirements, aspirations and priorities. Information is openly shared and we encourage customers to pass responsibility to us to manage their property and construction projects, using our in-house experience and expertise". [original website].

The company's use of technology has been limited to date. When the study began, they used the ubiquitous laptops/desktops with Microsoft operating and Office systems and a few specialist software packages: Asta PowerProject, AutoCAD and Sage Accounts. There had been little or no formal training in any of these systems.

5.3 Research Timeline

To aid the understanding of this project, the timeline of events has been established.

Time span	Description	Key decisions
September 2006 – October 2007	This work entailed the design of the MIS structure in paper form. A published academic paper (Douglas, Wainwright & Greenwood, 2008) highlighted some of the issues encountered during this period.	Information Structure Ideas for the 'Golden Rules' for information storage
November 2007	NR decided to change IT support companies.	Decision to leave SMEsup1
December 2007	This month consisted of an independent report on the existing computer (hardware and software) in operation @ SMEcon. Meetings with SMEsup2 and SMEint	Decision to employ SMEsup2 Decision to employ SMEint
January 2008	SMEsup2 audit SMEcon's IT systems	
February 2008	IT back-up issue – total failure of NR's computer resulting in catastrophic loss of information	Policy on Back-ups of all systems and computers.
March 2008	Work done on Version 2 of paperwork, to allow for Intranet-based Document Repository	Keeping documents in Office 2003.
April 2008	Continuation of March 2008's work	Structure of Intranet finalised.
May 2008	Continuation of March 2008's work. Website redesign	SMEint's account manager announces he's leaving SMEint
June 2008	Website Launch	New account manager at SMEint. Structure and wording of website confirmed
July 2008	Intranet redesign and Launch	New 'structure' in intranet system. Phased launch of new system onto new SMEcon projects beginning from 7th
August 2008	Holiday period in SMEcon. Monitoring of launch	
September 2008	Major Intranet redesign due to user issues	Decision to re-launch Intranet ASAP
October 2008	Work done on Version 3 of paperwork, to allow for Intranet-based Document Repository.	Switch all document types from Office 2003 to Office 2007.
November 2008	Continuation of October 2008 work.	Switch all users' computer browsers due to unforeseen technical issues.
December 2008	Re-launch of Intranet	Trial of user manual

January 2009	Training of site operatives and Handover of SMEcon's work to another researcher/SMEcon	Handover of SMEcon information

Figure 5.3a - Basic timeline of SMEcon events.

5.4 Pre-Research Context

The researcher will provide the reader with the background to both the company, SMEcon, and the researcher. The researcher has done this because;

- As an Action Research type study, the researcher believes it is vital for the reader to understand the relevant employment history and experiences of the researcher that may impact on the project.
- There were other projects within SMEcon that directly led to the Research project's motivations and structure.
- It will position the project into the real world environment of SMEcon within its lifetime – no action is independent of others.

Although the researcher, Allan Douglas, Professors David Greenwood and David Wainwright are not fully anonymised, the researcher had decided to use AD, DG and DW when discussing them.

5.4.1 The Researcher

The researcher, AD, was asked if he would be interested in applying for one of the new Research posts being offered by the School for the Built Environment at Northumbria University. This was to be part of a new intake of researchers that the University hoped would move the focus from mainly teaching to a more diverse, rounded university experience.

The opportunity to study had not been planned with regard to a career option as he was back working with the company who had originally allowed him to move to Newcastle upon Tyne. This was a short-term project within the specific working environment he had previously operated except it was dealing with head-office management issue regarding the IS adoption. The plan was to win a permanent contract after the successful completion of the MSc in Project Management. This had been discussed and was in the process of being offered. However, the interview, and subsequent Research offer arrived first and AD decided that this was too good and rare an opportunity to miss. From 1999, when AD graduated with his BSc (Hons) Industrial and Business Studies, he had decided that further academic work would be undertaken. He was aware that the UK Government's idea of increasing the number of university graduates would require him to take the next step up regarding his qualifications. He had planned to complete an MSc, which he did in Project Management

and it was from this work that AD met and discussed various career options with some of the school's staff, although originally, not with DG.

A Curriculum Vitae (CV) was sent to NR, via DG at the time of application. It lists, very mechanically, AD's previous work history, adding a few snippets of information for each post. At the interview, AD was able to further describe the skills attained through his various roles, specifically the more recent ones as Project Training Officer, Project Coordinator and IT Project Leader. These, allied to his knowledge of contract work within the built environment seemed to fit very well with the Research project going forward.

The researcher had just completed a project within HBM Ltd to measure the 'as was' situation in the northern office finance department to allow the adoption planning for the new IT system he had been training users on, both as a trainer and a systems coordinator in earlier posts. This allowed him to gain knowledge and experience on how to garner information relevant to the performance of the existing operations.

5.4.2 The researched organisation – SMEcon

SMEcon was first registered in 2002, becoming established in 2004, by the former management team of a major national construction company who operate throughout the North East of England. They previously managed a highly successful and well-respected organisation, responsible for a number of the region's major projects, including St. James' Park stadium in Newcastle-upon-Tyne, Dalton Park retail outlet near Easington and Sunderland's Winter Garden. SMEcon aims to provide maximum value for money to customers by combining a relaxed, friendly and flexible approach with a wealth of experience, expertise and professionalism whilst providing a complete range of property and construction services. The company is structured to reflect the way in which the construction and property industries currently operate. Eventually, five business streams will provide services in each of the stages of the property cycle: develop, design, build, maintain and manage. An aim is to ensure that customers receive professional advice and a high quality of service in developing and delivering property and construction services: To get the right building and have it built right. SMEcon's approach is to work closely with customers to fully understand their requirements, aspirations and priorities. Information is openly shared and customers are encouraged to pass responsibility to manage their property and construction projects, using their in-house experience and expertise.

At the beginning of the research project in 2006, they had thirty employees (this varies slightly, depending upon projects) with its head office of 10 employees, including the

directors, in an industrial estate in the Northeast of England. They set up SMEcon for the team of directors to “rid itself of the shackles of the plc to concentrate on using its skills and experience for the direct benefit for the people who really matter – employees and customers!’ [original website]. Their feeling was that large companies can’t change quickly enough to suit client demands and other industry developments due to bureaucracy, complex reporting mechanisms and a ‘lack of direct contact’ with the clients, suppliers and other stakeholders [Interview with Commercial Director, 19/03/07].

The company’s structure was initially based upon a framework that was introduced to the team in the late 1990s during their previous employment. This framework, along with their various individual and group experiences, gave them a clear goal as to the direction the company would go along with a clear method of accomplishing this. In 2001/2, before SMEcon’s start-up, NR was a co-author of a “Business Improvement through Risk Management” report to his board.

In this report, he worked with colleagues from within the organisation, as well as professional consultants and staff at Northumbria University, including DG. The report aim was to secure Board level commitment to action the implementation of a Risk Management strategy throughout the company. This would be done by initially gathering information, surveying the company’s performance, analysing the results before considering the required actions. Then the report would supply delivery options for the adoption of the Risk Management Strategy.

The report discusses Key Issues and Critical Success Factors.

1. *Risk management is a mind-set.* Managers should be conscious of risk management and incorporate it into their other management practices. However, overly bureaucratic and complex processes will submerge risk management into irrelevance. 'Box ticking' will not produce real business improvement. Managers need techniques that are *flexible* for use in everyday operations, but sufficiently *consistent* and *uniform* to allow proper comparison at the corporate level.

2. *Risk management and corporate ethics must work together.* Risk management programmes and ethics are related. A company's risk management strategy should consider the corporate Mission Statement and Policies and the factors that might impact on the ability to meet its objectives. This includes the organisation's ethics and values.

3. *Risk management is a dynamic process.* Risk management is about uncertainty and change. As business situations, needs and risks change, so may the organisation's risk management requirements. Thus, risk assessments cannot be one-off exercises and the organisation's success in managing risks should be monitored and continuously improved.

4. *Risk management should be interdisciplinary.* Many specialists' roles will be involved. For risk management to work most effectively specialist functions across all disciplines and parts of an organisation need to play a part. In addition to project teams, information technology, human resources, communications and financial management all have important contributions to make.

5. *Resources must be adequate.* Senior management must be committed to supporting the initiative with the required resources. Investment will be required in training, developing processes and techniques, management systems and setting up specialist groups.

Figure 5.4.2a - Key Issues in managing risk (NR & SP, 2002, p29)

The figure above describes the thought process that NR co-authored regarding Risk Management adoption. It is clear he saw Risk Management as an identifiable project that the firm required in order to perform at a higher level. NR then went on to describe issues that may be negative in the project's adoption, as shown in Figure 5.4.2b.

Potential threat	Examples	Action to overcome
'Missing the point'	• Excessive concentration on project risks at the expense of business and strategic risks • Concentration on risk as a threat (as opposed to possible opportunity) • Ignoring secondary effects of risk responses	Develop systematic procedures to consider all aspects of risk - corporate as well as project, opportunities as well as threats, secondary as well as primary.
'Silo-mentalities'	• Blame-shifting rather than problem-solving • Lack of cross-discipline co-operation • Isolationism	Develop procedures to bring together all disciplines, parts of an organisation or process to 'get the whole system in the room'.
'Ticking the box'	• Mechanistic application of risk management • Concentration on compliance • Duplication and 'audit overload' • Creation of 'paper chases'	Procedures that concentrate on business improvement rather than mere compliance. Encourage intelligent deliberation.

Figure 5.4.2b - Overcoming Threats to Success (NR & SP, 2002, p30)

The three threats, missing the point, silo-mentalities and ticking the box, are very anecdotal in their terminology, but thanks to the descriptions, are shown to be identifiable issues that can be measured. This allowed NR and SP to provide potential solutions.

It was in 2002 that SMEcon was registered by the three directors, NR, MT and TH. This was mainly due to the company that they were working for deciding to leave the UK marketplace. It would be another two years before SMEcon was fully trading as an entity. During this period, NR was able to focus his attention on to the ethos of the new company. Along with the other directors, they wanted to change the way construction companies were perceived, by operating in a more transparent way. They were committed to the 'change agendas' of Latham (1994) and Egan (1998), as well as other more recent developments, to adopt a new way of working within the construction industry. They feel that this should give them a real competitive advantage in the industry. [Interview with NR, 19/03/07].

In 2006, SMEcon were now beginning to achieve success and had a number of staff in specialised positions within the organisation. They began working with DG and DW on a major project, starting with two workshops, from which the original terms of reference are shown below.

Original Terms of Reference:
There is an opportunity to adopt a relatively 'greenfield' approach to develop simplified business processes, procedures, forms and documentation, towards the development of quality systems, best practice and, longer term, the appropriate selection of ICT applications and implementation within SMEcon. Best practice, both in terms of the context of business processes within the construction industry and also in terms of ICT systems management and delivery, will be identified for application within the business.

Figure 5.4.2c - Terms of Reference

The terms of reference then lead to an initial two phase plan, later extended to three phases, as shown below.

Three Phase Strategy
Phase 1: 'Process' - Completing the process mapping exercise and providing an interim report with recommendations: Target: 19th May (DW/DG)
Phase 2: 'Procedures' - identifying, analysing and streamlining the current SMEcon management procedures and information systems: Target 30th June (Daan Boll, Internship student/University of Twente/Northumbria)
Phase 3: 'ICT Support' - suggesting suitable ICT support for an integrated information management system that is compatible with SMEcon's needs and ways of working: Target: July 28th. (All)

Figure 5.4.2d - Three Phase Strategy, (Greenwood & Wainwright, 2006, p2)

These sections of the report show the overall plan for work between SMEcon, DG and DW, as set in May 2006.

In response to the need for more simple and standardised systems, a 'top down' process model has been developed by the research team and validated by SMEcon personnel.
The agreed process model should form the basis of responsibilities, processes and procedures (with associated standard documentation) within the company;
These elements (responsibilities, processes, procedures and documents) should be mapped against the high level model as a basis for their classification;
In classifying these elements against the model the twin objectives of simplification and standardisation should be paramount;
The resulting system should be captured in a loose-leaf (thus editable) systems manual;
The systems manual should be disseminated within the business in a short seminar / workshop.
Files/documents are being reviewed by the research team for their necessity / contribution / added value to the business and legal requirements.
SMEcon management to validate the results and any necessary amendments to be made (as a result of validation);
Documents in the new system to be re-named (using more logical classification names – to be agreed) and in exceptional cases redesigned;
The new document system to be implemented and monitored on a new project with a view to its adoption as SMEcon's standard paper-based procedure;
The new document system to be disseminated (through briefings) right across the SMEcon team.

Figure 5.4.2e - Phase 1 Recommendations, (Greenwood & Wainwright, 2006, p18)

Phase one, the Process phase had the recommendations shown above. It lists the actions already taken, regarding responsibilities, processes and procedures, before recommending the completion of various validation exercises and finally, a physical description of how the document system should look and work.
Phase two was completed by a visiting Northumbria University student from The Netherlands, Daan Bol (DB). His remit is shown below, and the company is again anonymised
The project focuses on the processes and procedures at SMEcon. The goal is to make recommendations on time and cost efficiency. The first step is to map the processes of all key elements of SMEcon. Because there is a large variety and the time-span is only three months, it is not possible to map them all. Therefore the focus lies on the key element Develop.
Mapping out these processes will be done by means of workshops and interviews. The results are the input for a specific business model. The model will be an overview of all processes and activities.
The second step is to review all the documents/files employees of SMEcon use in the Develop-element.
The third and last step is cross-referencing the first with the second step. The documents/files are reviewed for added value to the business and legal requirements. The 'willmaybin' system will be used for review; **will have, may have** and **bin.**

Figure 5.4.2f - Phase 2; Project Framework, (Bol, 2006, p5)

This phase was very time-constrained due to DB only working for three months in Newcastle, away from his home institution, University of Twente. His work was planned to revolve around the Develop section of the company structure and identify the necessary processes, procedures and documentation required for this part of the company.

5.4.3 The Aims and Objectives of the Project and Study

. The project's objectives were:

- To design and adopt a paper-based standard form library that is based upon desired working processes within SMEcon.
- To apply this model to a newly purchased DMS, including configuration of the DMS's workflow system.
- Adoption, user training and rollout of the DMS across SMEcon.

The overall aim was for SMEcon to have an operational DMS across all users that would create an efficient, standardised workflow model to manage their document processes. This statement was never explicitly made during the project. The aim of the study has also changed completely.

The study will analyse what happened in the SMEcon project with a view to answering why it occurred and what this could mean to wider SME communities. The objectives to meet this aim are:

1. Review of the adoption of a new paper-based form library within a small company and its effects on the business.
2. A review of the overall DMS adoption project and the decisions that lead to it.
3. Extrapolate learnings from review evaluation interviews
4. A comparison of this project's process with other documented studies

5.5 The Research Case

At this point, both the researcher's and SMEcon's timeline are in sync. From the previous work involving NR, SMEcon, DG, DW and DB was brought together to form the basis for the research application. Due to the complexity of the overall project, a longitudinal research study was identified as the most appropriate course of action. Another issue was that Action Research methodologies, whether explicit or not, had been successfully used in the earlier phases of the study, making that the main method for any further research opportunities within SMEcon. The research original remit is described in the following bid document.

> The design and development of an integrated construction management information system (ICMIS) utilising business process and collaborative groupware technologies
>
> Definition of the Problem/Opportunity
>
> SMEcon are a new venture SME, currently employing 30 professional staff based at the head office or working on construction sites within the North East of England. A considerable level of skills, knowledge and expertise exists across the combined workforce which is an accumulation of the competencies developed from former large construction company employers. However, much of this diverse and detailed knowledge is in tacit form: it includes know-how related to business and construction processes, procedures, information requirements, reporting, control and complex legal

requirements for the business. Furthermore, this knowledge is derived mainly from large company experience, and requires to be adapted to the needs of an SME going through a growth phase with an explicit business mission and philosophy of loyalty based on an embedded North East culture combined with the development of client relationships based on mutual trust, risk sharing and partnership.

There is, in the construction industry generally, a dearth of standard business process representations combined with agile collaborative information technologies to enable efficient and effective management reporting, control and decision making. SMEs are particularly vulnerable in this respect - not being of sufficient size to invest heavily in new information and communication technologies and generally lacking the professional resource to develop and maintain them.

The key business problem (and opportunity) to be addressed by this proposal is to develop, implement and monitor an effective, easy-to-use and low cost solution for defining and providing both structured and ad-hoc operational and management information to key project personnel and managers based at any geographical location.

Background and State of the Art

SMEcon have undertaken joint project consultancy work with a team from Northumbria University to instigate a review of its business model. This is based on high level mapping of business processes and procedures using process modelling software. The project utilises academic research related to business process modelling (Vakola, 2000; Waring and Wainwright, 2002), the development of knowledge systems and groupware communities (Hayes and Walsham, 2001) and newly available groupware technologies such as Microsoft SharePoint Portal. Contextual knowledge is derived from research on industry standard business models from the Construction industry.

Current research indicates that SMEs (as opposed to large enterprises) within the Construction Industry are not very innovative or active in terms of developing, implementing, adopting and diffusing new information and communications technologies (Acar et al, 2005). Research to date has mainly focused on, and benefited, large construction enterprises who are developing complex distributed computer systems for co-ordination and management of project activities across diverse geographical locations. Many European Commission framework programmes have funded these efforts resulting in projects such as ‘Atlas’, ‘Condor’, ‘Osmos’ and ‘e-Cognos’ conducted between 1992 and 2004. These were complex software development programmes developing reference ICT architectures for the construction industry together with prototype developments involving many consortium partners, principally end users, universities and large software houses. These projects had goals of enabling construction enterprises to act and collaborate effectively by utilising value-added internet-based flexible services to support collaborative working and teamwork in the context of the virtual enterprise (Ferneley et al, 2002; Wilson and Rezgui, 2002). Much of this work is highly innovative and technically advanced but has not been effectively disseminated or adapted down to the level of most construction sector SMEs. There is a need to review these innovations utilise the core concepts, ideas and architectures within small business environments utilising low cost and readily available packaged software solutions such as Microsoft SharePoint Portal or similar collaborative groupware technologies.

Aims and Objectives of the Project

In terms of practical aims for SMEcon, a fully operational system needs to be designed, developed and implemented, guided by the development of industry- and SMEcon-specific business process models, practices and procedures. In terms of academic objectives the contribution to theory will focus on the development of a framework incorporating: business process design methods and techniques, methods to enable knowledge and collaborative socio-political working within a construction project management context, and a philosophy based on participation and organisational learning. These developments must be sustainable and appropriate for the SMEs which represent the great majority of the Region’s (and indeed, the Nation’s) construction firms.

Proposed Activity

The PhD work will be conducted by using co-operative inquiry and participatory action research methodology, utilising prototyping as an iterative development approach for the design, development, adoption and diffusion of the collaborative groupware system. State of the art business process and enterprise modelling software will be used to develop the SMEcon specific and industry standard

models. The models and prototype collaborative system will be developed under supervision at the University. Piloting and roll out within the live industrial environment. Specific activities will include:

Conduct full scale 'as is' and 'to be' business process modelling for SMEcon;

Identify Construction industry standard processes and procedures, adapt within SME context;

Evaluate state of the art collaborative groupware technologies for fit within construction SME and SMEcon context;

Acquire, design, develop and implement suitable integrated construction management information system;

Iteratively adapt and refine system to provide capability for organisational learning;

Develop integrative framework for ICT development, adoption and diffusion in the construction SME sector;

Disseminate good practice and findings. This will be done within the North East with the assistance of organisations such as Constructing Excellence and nationally and internationally through academic and practitioner-orientated events and academic publications.

Expected Outcomes/Benefits from the Project

Phased delivery of a prototype, pilot system and full operational ICMIS for SMEcon practical operations and also Northumbria University as a research simulation.

PhD with significant contribution to theory relating to the development of reference business process models and participative development methods for groupware collaborative systems in the construction domain.

Significant financial benefits for SMEcon in terms of efficiency gains from enhanced ICT systems capability, new marketing opportunities and development of competencies through organisational learning.

International publications for the research team to disseminate key findings to both academic and industry practitioner audiences and contribution to the RAE.

Contribution to the North East regional economy through the parallel dissemination of good practice relating to business process management and ICT adoption within the construction and SME sector (through workshops, seminars, university teaching, short courses and sector specific publication).

Development of strong collaborative inter-disciplinary research interaction between university Schools of Built Environment and Computing, Engineering and Information Sciences and the Construction industry sector.

Brief Details about SMEcon

Further details can be found on the company website.

Figure 5.5a - Section of original ESPRC Letter from SMEcon

As can be read, the document encapsulates large portions of the earlier work and uses them as the basis for the project. This allows the research to be read in conjunction with projects before its inception, giving it a contextual basis. Chapter Seven Findings, will enhance the importance of this contextualisation, both in terms of the project outcomes and the methodological approach.

5.5.1 SMEcon Initial Status Observations

The research began at the end of September 2006. The researcher did not begin the Action Research (AR) element until January 2007, as NR, a Director of SMEcon was not in a position to collaborate due to work commitments. The researcher utilised this period to begin familiarising himself with the adopted research method, Action Research; with literature on small and medium sized enterprises; readings that concerned information systems adoption; and undertaking several research training courses based in the university. However, the researcher did investigate some of the available SMEcon operational information.

SMEcon already used a mix of laptops and two desktop computers, all with Microsoft (MS) Windows XP and MS Office 2003 suite products generally available. They also used two, more specialised software systems, Sage Accounting and Asta PowerProject. The decision to purchase Asta was based upon NR's previous exposure to its use. Both of these systems incurred an annual support and licence fee.

The Sage adoption was driven by the needs of SMEcon's finance function. Through purchasing this package, mechanisms for data capture and reporting were required and the creation of purchase requisitions, business mileage forms, and other similar reports were expedited. These data-capturing forms (MS Word and Excel-based) were initially based upon previously recognised layouts and enhanced to match the data necessary to drive the Sage software.

The forms created the basis for operational and statutory data recording; from new starter forms to customer questionnaires. There was little or no automation in the company apart from one or two MS Excel spreadsheets which only worked independently. They did not provide separate reports or feed information to other documents. Indeed, the majority of software used created forms to be printed, manually filled-in (hand-written) and faxed or posted. Emails could be used if the site-based recipients had internet access and printing facilities. All sites were required to keep a paper-based system with all correspondence, reports, etc.

As well as these, the company also had a web presence, which had not been updated since the site's initial launch early in 2006. It acted as a brochure, mainly giving snippets of information about the origins and ethos of the company as well as contact details.

5.5.2 January 2007 – July 2007

The first action discussed with NR was the need to create the Management Information System (MIS) on paper. Standardising the aforementioned forms, which were originally copied from a variety of previous establishments worked at by the directors, would create the first derivation of the MIS.

NR wanted to base the new SMEcon system upon 'SMEcon'd forms' – forms that had a common template involving the company logo and standardised code-numbering system in a set location. These forms would also share a common font and colour system, all to be set by NR. The logic behind this was that a paper-based form system, tailored to SMEcon's information requirements, would be an excellent basis upon which to setup an Electronic Management Information System. The researcher was asked to take the random electronic versions of the forms already collected from previous work and reformat them into the standard templates. This work was checked and progressed during the next 5 months, with weekly sessions with NR as to the final layout and numbering order.

Along with this work, the researcher broached the topic of how the envisaged electronic system would work. Initially, NR did not want to distract from the creation of the paper-based MIS. The researcher also discussed how the management processes would need to be identified and decided upon. Again, NR did not want to consider these points at this time in the project.

NR also decided that the work being done in creating the MIS would not be communicated to anyone else in the company. The researcher worked, with NR, in the conference room within the offices.

In June, the researcher was made aware that two staff members, who had left the previous month, had 'taken' commercial company information with them. It was reported that they had managed to work, using the company's computers and existing system for over two years, without saving any work onto either their assigned laptops or the central filing system on the server. This meant that when the information was required after their leaving date, nothing could be recovered. This looked to have been pre-meditated on the part of the leavers as there was no other obvious reason for the work not to be stored centrally. NR also stated that the former employees had started another company in the same business area. This raised many questions of policy, process and systems regarding security of information.

5.5.3 July 2007 – November 2007

After the events reported in June, NR and the researcher began discussing the need for rules involving information storage. The process of document creation progressed to the point that SMEcon were able to launch the new paper-based document management system. This entailed a meeting with all staff at the Gateshead office where NR introduced the new system as well as the researcher to everyone. Below are the agenda notes the researcher made in discussion with NR, before the meeting.

1. Intro for me – CV for NR.
    a. Keep PhD topic separate from work.
    b. No links to my previous roles
2. Hand out system docs. Brief explanation of company structure
3. So far – doc system, intranet – roll out soon.
4. feedback - e-mail address, phone.
5. co-ordinate only – not own.

Figure 5.5.3a - Agenda for MIS Launch Phase 1

This meeting took place in September and generally met with very little comment by the staff. Indeed, the only comments were that the new forms were needed, and they had been waiting some time for them.

However, there was a large volume of feedback once the staff began using the forms, mostly consisting of issues around ‘box spacing’. This concerned the fact that, when the forms were designed, they were for use online i.e. for typing into. This was problematic, as the forms were not yet being used online, meaning they were being written on. The spaces were too small for most of the users’ handwriting. NR and the researcher reviewed the comments, with the researcher making the necessary alterations to what was now labelled, V1 (‘Version 1’) of the document system.

Another issue to appear from the feedback, was the sheer amount of forms in the system, most of which seemed to be rarely, if ever used.. During NR’s and the researcher’s discussions around this matter, NR reaffirmed that all documentation required for the company should be within the system. Users would need to ‘get used to’ where relevant forms for them would be stored. Indeed, NR designed the system to separate forms into sections, applicable for individual sets of users.

Company Logo

D1-10

Project Filing Index

1.	Planning	
1.01	New Project Information Sheet	D1-01
1.02	Construction Commencement Meeting Agenda/Minutes.	D1-02
1.03	Project Management Plan	D1-03
1.04	Project Programme	D1-04
1.05	Requests for Information	D1-05
1.06	Information Required Schedule	D1-06
1.07	Requisitions	D1-07
1.08	Procurement Schedule	D1-08
1.09	Sub-contractor, Consultant and Statutory Authority Procurement Schedule	D1-09
1.10	Project Filing Index.	D1-10
1.11	Project Meeting Agenda/Minutes	D1-11

2.	Design	
2.01	Professional Indemnity Insurance Record	D2-01
2.02	Design Development Chart	d2-02
2.03	Design Team Meeting Agenda/Minutes	D2-03
2.04	Design Change Request	d2-04
2.05	Design Change Register	d2-05
2.06	Document Register & Issue Sheet on each project	D2-06
2.07	Drawings and documents issued externally will be forwarded under cover of a letter detailing the items being distributed	D2-07
2.08	Drawing and Document Control Flow Chart	D2-08

3.	Financial	
3.01	Project Risk Profile	D3-01
3.02	Project Profile Report	D3-02
3.03	Elemental Cost Plan	D3-03
3.04	Tender Summary	D3-04
3.05	Project Proposals	D3-05
3.06	Contact Documents	

4.	Site & Technical	
	Inspection and Testing	
4.01	Inspection & Test Plan	D4-01
4.02	Inspection & Test Record	D4-02
	Project Records	
4.03	Daily Site Diary	D4-03
4.04	Goods Received Schedule	D4-04
4.05	Plant Hire Schedule	D4-05
	Change Control	
4.06	Confirmation of Verbal Instruction	D4-06
4.07	Instruction to sub-contractor/consultant/supplier	D4-07
	Project meetings	
4.08	Sub-contract Meeting	D4-08
4.09	Client Project Report	D4-09
	Administration	
4.10	Vacancy Authority/Offer of Employment Details	D4-10
4.11	New Starter Form	D4-11
4.12	Change of Personal Details	D4-12
4.13	Holiday Request Form	D4-13
4.14	Self-certification for Absence Form	D4-14

Page 1 of 3

Figure 5.5.3b - Page 1 of the Project Filing Index V1 as published in September 2007

For example, the Planning and Financial sections were mostly office-based forms, for use by the Estimating Manager, Procurement Manager and finance staff; whereas Section 4, Site and Technical, held most of the day-to-day operational documents necessary on the sites.

It was at this time that the researcher and NR discussed how the new MIS may be able to operate. It became very clear that NR envisioned the adoption of a new system that would store the newly created documents in a central repository, available to all staff no matter what their location. The researcher had the following observations about this approach:

- By adding the existing documents to a central electronic storage facility would be replicating the existing paper-based, folder system in operation through the company.
- This would not 'add value' to processes.
- This would not be a MIS that allows computer processing and reporting. It would be a Document Management System (DMS)

NR maintained that:

- The system would reduce duplication of paper systems between the sites and the office.
- It would ensure everyone was working from the same, shared documents.
- The security of the system would allow SMEcon to ensure that all staff stored documents where they should be.

NR also believed that a more complex MIS, using databases, was a step too far at this time in the company's development.

5.5.4 December 2007

This month saw the independent investigation by D. Hagan and subsequent report that accelerated the overall project's development. Up to this point, SMEcon had struggled to move the project on technically, mainly due to SMEsup1's inability/unwillingness to communicate at a greater level in order to facilitate the project. The report highlighted technical issues with the existing infrastructure as well as making recommendations about upgrades and even a suggestion of which document management (Microsoft SharePoint, more commonly known as MS SharePoint or SharePoint) system may suit SMEcon.

The report started by describing the technical architecture.

> *Windows Server 2003 (Small Business Server) is the operating and network system with Windows Microsoft Exchange Server 2003 used for email and folder/file sharing. The company website is externally hosted and a mixture of MS Windows Office 2003 and 2007 are used on individual laptops. MS SQL Server is only partially installed*

(Check this for operation with SharePoint) and MS SharePoint WSS2.0 is installed as standard and is accessible internally and externally.

(Hagan, D., 2007)

The report then described the cabling and networking structure before giving more specific details on the incumbent document repository system that form part of the MS Server 2003 system.

Requirements for MS SharePoint Initiation and Configuration	
Item	Description
1	Need access to SMEcon network (can add to mobile users group?)
2	The researcher now has access
3	url and external ip address exist (ask what the server external domain name is from SP at SCL)
4	SharePoint has been configured for existing users – can access this through Site Administration. Initial work has been performed to set up Shared Filing System based on the SMEcon Categorisation System (as defined by SMEcon director and updated with subsequent work).
5	The researcher now has log in access and can demonstrate what has been configured so far. He can now use site administration to set up users and configure permissions and security levels etc.
6	The initial SharePoint system has been configured with existing folders and file structures. This can now be extended and used on a pilot level with a selected number of users. Warning – these are duplicates and kept separate. Can SharePoint access and link to the Network shared folders (on shared drive)?
7	SharePoint, as currently configured, does not seem to have a full SQL Server installation. Question – how will this impact on development of the system?
8	Currently, the SMEcon project team are set up within the SharePoint Administrators group. These have full privileges for systems administration.

Figure 5.5.4a - MS SharePoint System from System's Architecture Report (Hagan, 2007)

The remaining section of the report gave suggestions for additional systems requirements, along with rough potential costs, suppliers of such systems and a summary of necessary actions.

Additional Systems Requirements	
Item	Description
1	Need for Discussion and Agreement regarding an annual IT Budget. Split into Capital expenditure and Revenue (recurring maintenance, applications support and development, and training).
2	Purchase of new Dell Server? (Intel core 2 duo processor, 4 Gbyte RAM, 2 * 300 Gigabyte storage in a RAID array (fault tolerant) = LCD 17" monitor ?- £1500? + Replacement support package – Tower System + 24 hour on-site repair/replacement warranty (DELL).
3	Or Possible second 300 Gigabyte Drive for data – archive separation

4	Possible full installation of SQL Server (alongside Small Business Server) for full operation and capability for WSS2.0 SharePoint. Cost TBA
5	SBS Windows Server 2003 – need to ensure the requisite number of licences (CALs?) also for Office 2003/2007 and SharePoint WSS2.0
6	Determine upgrade and migration path from MS Office 2003 to 2007. Cost TBA
7	Determine policy regarding upgrading or (staying with) from MS Windows XP to MS Windows Vista (for laptops and workstations client machines across SMEcon)
8	Determine possibility of upgrading from WSS2.0 to MS SharePoint WSS3.0 that runs on Windows Server 2003? TBA and cost TBA
9	Keep watching brief on need to upgrade to Windows SBS 2008?
10	Cost – MS SharePoint Training (for up to 5 users – initially the researcher plus TBA) – from Site Administration to Site and Document creation, management and customisation.
Short List of Possible Preferred Suppliers (SharePoint Services and/or ICT maintenance and support)	
Item	Description
11	www.waterstons.com – possible training?
12	www.datawright.com
13	www.sis4it.com
14	Possible independent contractor
Actions	
Item	Description
15	Suggest meeting with SMEsup1 with prepared set of questions:
16	His availability, timescales and costs for IT support and maintenance (General infrastructure) – to include MS Server, MS Office upgrades (2003-2007) and SBS 2008, installation of new Server hardware etc. Is there a Service Level agreement.
17	If cannot commit – or offer appropriate SLA – then source from alternative Supplier. Get quotes from preferred supplier list.
18	Technical questions over Windows/SharePoint Server upgrade from WSS2.0 to WSS3.0.
19	Technical question over role of SQL Server and installation. + costs
20	If SQL server – do you need separate processor/Box (due to intensive data access)
21	Technical question over whether standard shared folders on shared network drive can be attached to SharePoint (as opposed to duplicating everything).
22	Technical question over current number of licences (MS office, XP, Vista, SBS, Exchange and SharePoint)
23	Costs of upgrading or increasing number of licences (also types? CAL)
24	Cost Training for SharePoint – suggest 3 delegates, Waterston's?

Figure 5.5.4b - Report Recommendations from System's Architecture Report (Hagan, 2007)

Immediately prior to this report, the company's ICT-based systems were 'being looked after' by a small ICT consultancy, SMEsup1. However, this ICT consultant had become dilatory, and appeared to have reached the limit of support that it could offer SMEcon (this timeline is explained more fully in Chapter 5). Shortly after the independent report, SMEcon signed a

six month contract with SMEsup2. The choice of SMEsup2 was based upon personal recommendation, ironically from the former ICT support company. This type of recommendation, although highly likely to occur in large organisations, would almost certainly not have been taken up as quickly, or without other 'sign-offs' from senior management and budget holders. Therein lies a major perceived benefit of SMEs; the people doing the work, pay for the work. Bureaucracy, tendering, procurement 'rules' etc., are less likely to be blocks to decisions to the same degree that that they are in large companies or public organisations. However, the procurement issues in particular, may allow large organisation to truly receive the best provider of service if they use a measured competitive tendering process, whereas an SME's approach may be more 'ad-hoc' and personal, increasing the risk of sub-optimal technology choice and lock-in.

The agreement was for SMEsup2 to upgrade the existing infrastructure and maintain the system thereon. They would also be responsible for any other hardware and 'off-the-shelf' non-specialised software solutions, such as MS office products, etc.

The new company had a busy period, with major updates required in the MS Small Business Server that controlled SMEcon's email account and shared drives, as well as their security software. As with many system upgrades, this caused some unforeseen outages, where individual's computers would not link to the network for periods. SMEsup2 also advised that the office should be 'wired', rather than dependent upon the wireless network already in situ. This was due to the potential for hacking into the network, thus bypassing the main security system in place on the server. NR agreed to this project, but agreed with SMEsup that some wireless facility would be required for visitors, etc. This was especially useful regarding the researcher's laptop, supplied by the university for the duration of the study, as there was no available extra desk-space if all the staff were present.

From this appointment, the researcher was included in a meeting with SMEsup2 and SMEcon where discussions took place regarding potential Intranet solutions. SMEsup2 informed us that they did not have that type of capability but could recommend a firm local to them ("just along the corridor") that provided such solutions. NR contacted this firm, met them along with the researcher, and signed them as the Internet/Intranet supplier, SMEnet.

A final change this month was the information that the Office Manager was marrying one of SMEcon's three directors.

5.5.5 January 2008

SMEsup2 undertook a full system and infrastructure check, including upgrade of server memory as advised by the previously mentioned report. As well as this development, SMEint required a lot of information pertaining to SMEcon's ideas of what the intranet and internet should do.

The internet pages were relatively simple to go through, as there was an existing example in place. This meant that the NR had some experience with what the design process involved. However, his experience was not a positive one, as the previously contracted internet designers had not been flexible with the overall design, leading him to doubt what may be possible, regarding editability and updating of the site.

This led on to discussions about what the intranet pages would require in way of image, structure, functionality, etc. Most of these questions were new and had not been thought of by SMEcon. NR had a clear 'vision' of what a paper-based system should do, but, due to lack of experience, did not appreciate the complexity now involved with an electronic version such as user access, document types, search facilities and filing requirements. It was planned that the researcher would be given the responsibility of leading this part of the project, based upon his exposure to similar systems and experience within computer system implementation.

Another consideration at this time was connectivity. The North-East of England does not have 100% mobile phone coverage, in spite of what is advertised by the Communications and Phone companies. This posed a fundamental question; should the MIS be transferred to a live Intranet Systems? NR, after some discussion, agreed that it was suitable. Any new building sites without internet access could not be known about now and would have to be dealt with on an 'as and when' basis. Also, it was argued that the majority of contracts would still be connectable. This was the deciding factor for the project to adopt an online Document Management System.

On the 23rd of January, SMEcon held their first ever management meeting. This was an interesting experience to the researcher. He had attended, and led, many management meetings in previous employs but never one that ran from 9.00am until 2.00pm, some five hours, although this did allow for a half-hour lunch break.

The meeting's duration was primarily caused by all attendees being allowed to delve into every detail of all the building projects, from their own viewpoints. i.e. the projects would be described in intricate detail by the Construction Manager, then re-discussed, this time by the

Procurement Manager. This process repeated until all attendees had had their say. In the researcher's opinion, this was not a management meeting, more a project meeting, with all projects being discussed. During this meeting, the researcher, who did not, and was not able to, comment on all of these building projects, presented his report on the new document management's system adoption progress, using the form shown below.

Company Logo

K4-02

Business Systems Report

Report Period 2
(Dec = 1, Jan=2, etc)

Report Month January

Performance Measurement

Paperwork	Division	Develop	Design	Build	Maintain	Manage
1st Draft (Paper)		21/09/07	21/09/07	12/01/07 – 21/09/07		
Complete (Paper)				21/09/07 -		
1st issue (ICT)				25/02/08 -		
Complete (ICT)						

ICT	Stage	System Design		System Delivery		Handover
		Investigation	Testing	Implementation	Training	Release
Status		13/02/08	25/02/08 -			

Issues and Improvements

- Version 2 of paper-based documents in Build due for release.
- Intranet will go online with Version 2 of the documents.
- Training on intranet will be designed, written, planned and implemented.

Prepared by:	ASD	Signed by:	Allan S. Douglas	Date:	18th Feb. 2008

Distribution: AH / NR / MT – (via IT)

Page 1 of 1

Figure 5.5.5a - Copy of Business Systems Report

The report was designed in collaboration between NR and the researcher. It is split into two distinct areas; the first, based upon a 'traffic light' style grid, reporting the progress, or otherwise, of specific sections of the project. The second section was a bullet point section reporting any specific issues or improvements. These bullet points were expanded upon during the meeting. After the meeting, which lasted 4 hours, the researcher discussed the format of the meeting with NR. The meeting had been very long and had turned into a detailed project-by-project discussion, by each person responsible for their section of the work i.e. the Construction Manager gave his view on every project, followed by the Commercial Manager, then the Procurement Manager, and so on. This meant that there had been no clear overview about the company's performance or specific issues.

5.5.6 February 2008

This month began with a major problem. The main instigator of the whole project, NR, lost over three years of information from his obsolete laptop during its replacement. The cause of the physical loss was uncertain in spite of investigations by SMEsup2 but highlighted the need for a robust policy on document storage i.e. back-ups. The full effect of this data loss was not disastrous but did delay various works that NR was working on in his role as MD of SMEcon.

The researcher and NR were also involved in more *requirement and design* meetings with SMEint. It was at this time the researcher was asked to take the lead in this process. The director and the researcher were to discuss 'company' requirements, and then the researcher was to discuss these with SMEint. This was mainly due to 'technical language difficulties' between non-IT people and those that work in IT continually, although the extra work now being done by NR following the loss of information in the previous month, was a contributing factor. The two companies had very different terminologies and understanding of each other's operations, whereas the researcher had experience in the computerisation of processes in other built environment-based organisations.

5.5.7 March – April 2008

The effects of the information loss from the previous month's IT problem did not affect the researcher's work. This is due to the researcher recently having received all documents tied to the project by file transfer in December, creating a back-up to the main files. The researcher then copied all of the files to a 'cloud-based' storage system that he had signed up to, ensuring some level of file back-up would continue.

One direct impact of the problem involved the apparent damage to the business relationship between SMEcon and SMEsup2. The researcher witnessed a lot of 'bad mouthing' of SMEsup2 from other SMEcon staff members, witnessed by the researcher. Evidently, the situation had been a point of conversation, or gossip, leading to a negative view of SMEsup2's abilities to function to SMEcon's requirements. As the researcher was not in the offices at the time of the problem, it is unclear who else was in the vicinity of NR and his discussions with SMEsup2 at this point, making the source of the gossip, and their understanding of the issue, unknown. The general comments were "...it never went wrong with 'SMEsup1'" and "well, we're paying a lot of money for 'SMEsup2' to look after our computers". The reason for the second of these comments became clear when the researcher found that SMEsup1 charged SMEcon per computer, as and when they required a new one, and added a fee at the same time for any maintenance. SMEsup2 however, charged a monthly fee for the upkeep of all the systems, including software updates, and charged SMEcon a standard rate for hardware, depending upon what was required. This second arrangement seemed much more robust and professional compared to the ad-hoc arrangement from the earlier supplier.

April 2008 was a very busy month, with the researcher and NR holding meetings to finalise the structure required for the new documentation system, based upon NR's view of what SMEcon would require. The system would be in two main levels – Company and Projects. The Company information access was to be held at director level only, whereas Project information must be accessed by project 'relevant' employees i.e. only employees tied to a specific project would have access to that project's information. This Project level was to be subdivided into five main sections, each reflecting the planned corporate structure of SMEcon as it grew – Develop, Design, Build, Maintain and Manage. The 'Manage' section, however, was to be split into two, one for Property Management and the other for Project Management, which reflected the vision of NR and the differences between these management processes. The structures within each section would be based upon the Build Structure, as this was the main activity of the company at the time.

This simple 2-stage structure was questioned by the researcher, who felt that it would not cope with the demands for reporting as the firm grew. He noted that most companies seem to have at least three levels of hierarchy; operational, tactical and strategic. The operational level is the day-to-day running of work, involving order forms, receiving and receipting good and services, along with general personnel issues and work control. Tactical is required to bring together separate elements and be able to measure, compare and report what is actually happening, in order to make planning decisions. For example, the Procurement

Manager needs to know what's happening on all of the projects, so s/he can locate orders to receive the best economy of scale s/he can for that product or service from the suppliers. The final level, as described by the researcher, is the Strategic level, which is made up of the top decision makers; in this case, NR, MT and TH. They own and direct the company, making the decisions upon which everyone has to comply with.

5.5.8 May 2008

A huge volume of communication was undertaken regarding website design for the internet, specifically editing and control, and the implementation of the flash movie.,. This involved electronic mock-ups, implications of web-page formatting requirements, security and content. NR, once given some suggestions and recommendations on how web-pages looked on screens, created the wording and picked photographs that would suit the company's marketing needs. The initial loading of this information was done by the researcher using the administration system, or 'backend' that controls the web content. This was a very simple process. (Due to the amount of referencing to the company's name throughout the website, the researcher has decided against providing a screenshot example to preserve the anonymity of the organisation.)

The project was then hit with the following sudden announcement from NR, the Commercial Director of SMEcon

> *"I wanted to get in touch with you both to give you some news as it will have a bearing on the below. I've been presented with a new opportunity that means I'll be leaving SMEint in the next few weeks. My colleague ...will be handling our Newcastle business from that point; she's actually working with me from the office here for a couple of days each week until I leave on 13 June.*
> *Obviously this means that I can't make the presentation on 18th, but she has already put that in her diary – you'll be in safe hands!*
>
> *In terms of launching the website next week I don't see any issues with that at all: we've changed the wording in the Flash movie and the formatting works for us – could you please check that you're happy before sending live.*
>
> *I'm just waiting for confirmation that we have the control we need on the domain name in order to set the changes so the site is live next week. Ideally we'll sort that all out this week so it's ready & live for you come Monday."*
>
> SMEint contact 1

This announcement initially caused consternation, especially with the researcher who was mainly dealing with SMEint. A change of personnel at this stage of the project's development would be difficult to manage. One of the major obstacles to appear was the technical language used in such a project. SMEint contact 1 had built up an understanding and rapport with the researcher and NR. This had been achieved over the months of working

together, and getting to know how each other operated. This was very different with SMEint contact 2. The historical data, with all its nuances was, although 'handed over', not understood in the same manner.

5.5.9 June 2008

The website was launched on 09/06/09. The wording was written by NR with 'structural' advice from SMEint through the researcher.

This 'structural' advice contained information on how to keep the website on one page. This is vital as, according to internet designers, most users will only look at a website for a very short period of time, meaning that the information to draw them into the site for a longer duration must be interesting and visible immediately. Photographs also needed to be interesting but relevant to the content of the web page.

Armed with this information, the site was populated, with a few minor alterations along the way. The results cannot still be seen at as the site has been updated since its launch with a new supplier and functionality. The researcher then began a series of final design meetings with both SMEcon and SMEint. However, at this point a major problem appeared.

The initial company structure was based upon two levels; Projects and Company. All project information would be stored in Projects, and all 'sensitive' information would be held at Company level. The researcher asked where cross-project information – from Management meetings, etc. – would be held. NR said it would be at Company level, as this would hold information not to be seen by other projects. However, this meant allowing many more users into Company level, meaning they too would be able to see other sensitive information. This was a huge problem and the project was four weeks from Intranet launch.

The outcome of a series of hurried and harassed emails to and from SMEint, was that a third level, Management, would be added to the site. This was not without its own difficulties. This section would need to have differing authority levels for users, to prevent information from being freely available. This was much more complicated than the previous system where users were either allowed to access their work in *Projects* or see all *Projects* AND *Company*. Now the research team needed to map users to their work in Project and decide what sections of this new level, Management, they would need to see. Then it could look to see if *Company* was required too. Grids to represent the changes are shown on the following page.

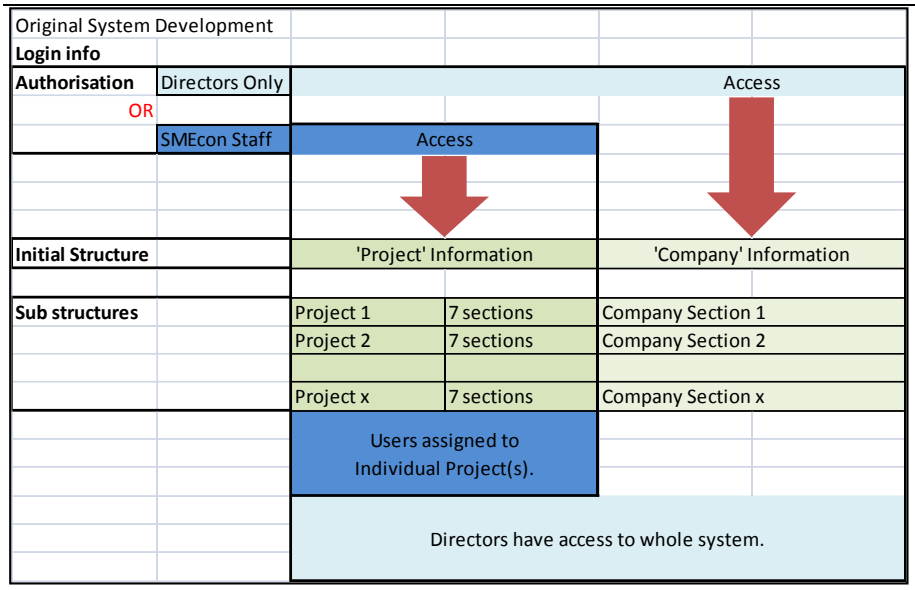

Figure 5.5.9a – Original System Structure

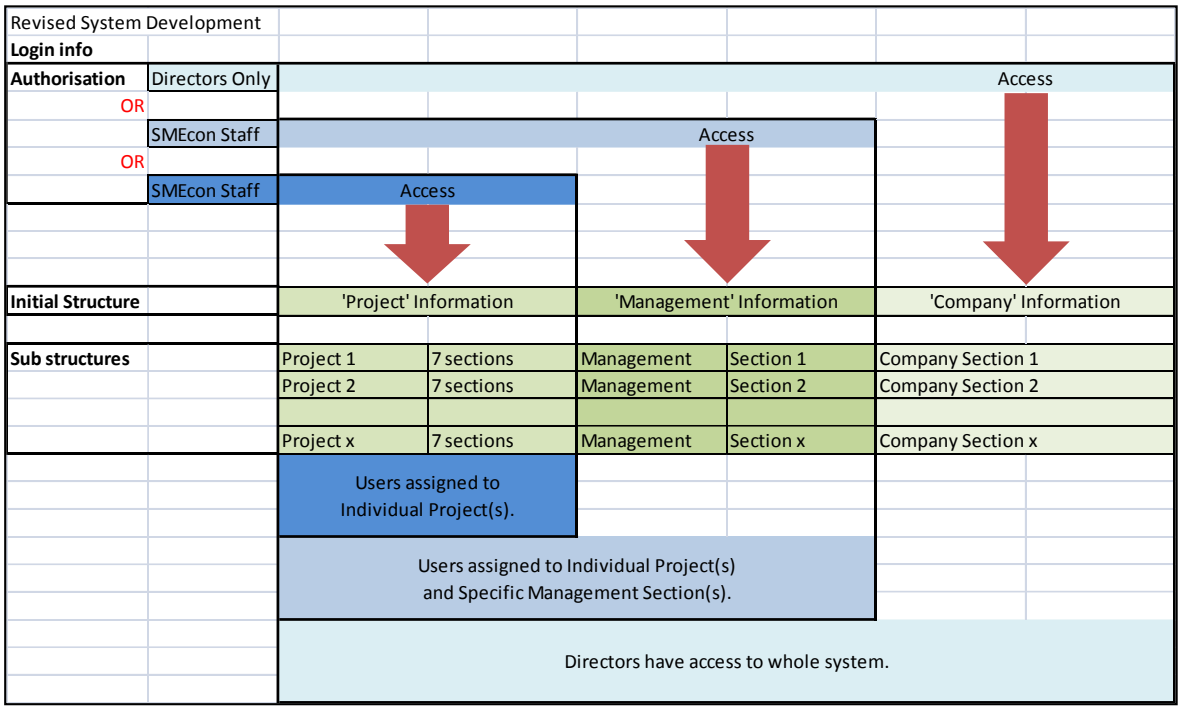

Figure 5.5.9b – Revised System Structure

5.5.10 July 2008

After numerous emails, meetings and phone calls, the project was ready to Go Live on July 7th, 2008. Within a week, SMEcon halted the live process due, in the main, to the following issues:

1. The site manager's computer was having intermittent issues with using the 3G card making it unreliable. It was replaced but to no avail.

2. The site manager chosen for the first phase of roll-out could not connect to the system from site. This was eventually shown to be due to a limitation with the 3G card supplied to him – it wouldn't work through thick walls! The site had some buildings already on it, which were assigned to be site offices. This meant that the system could not run on that site.
3. The discovery that SMEcon would need more flexibility in the 'structure' of the document repository. i.e. another level of data storage.

The issues with the 3G card were not expected. Other users had used them successfully in similar environments but they had not been tested in this specific setting. This was unfortunate, as building sites are organised to suit site access, rather than to utilise IT or receive a phone signal.

After much discussion between, NR, SMEintcon2 and the researcher, a decision was made regarding a new layer of information that would be specific to an individual project and could be added whenever it was required. The scenario that led to this was the Correspondence filing issue. At any time, a letter/fax/email could arrive at a project from any of the stakeholders – subcontractors, clients, client's agents, architects, Health and Safety, etc. It is standard practice to file these by the name of the organisation they are from. To do this, each project must set up a folder, with this name, and file the documents in date order.

The researcher and NR had long discussions about this. 'Why', the researcher asked, 'did it need to continue in this manner?'. The system would allow for any documents to be filed into it, with whatever naming convention you wish to use, and will time and date stamp it on entry. This would do away with any project specific, named folder within which to file. NR argued that this would change too many things for the users (filers) and lead to confusion at site and the office, as this was not how it was done. The decision was also made to pilot trial the new system when it was ready. The user and site would be decided upon by NR.

The figure below shows part of Section 4 – Site and Technical, from the Build Project Filing Index as of 09/07/08. As can be seen, there are no Document numbers (BLD) set for the correspondence sub-sections, unlike the previous sub-sections. This was due to there being no standard documents to be placed in the system. However, the 'space' was created in which to file.

Section	Sub-Section	Item		
	Folder		*Document*	*Document No. (if any)*
	Administration			
		4.10	Vacancy Authority/Offer of Employment Details	BLD4-10
		4.11	New Starter Form	BLD4-11
		4.12	Change of Personal Details	BLD4-12
		4.13	Holiday Request Form	BLD4-13
		4.14	Self-certification for Absence Form	BLD4-14
		4.15	Allocation Sheet	BLD4-15
		4.16	Business Mileage Record Form	BLD4-16
		4.17	Business Expense Claim Form	BLD4-17
		4.18	Petty Cash Record	BLD4-18
	Completion and Post-Construction			
		4.19	Customer Feedback	BLD4-19
		4.20	Project Review	BLD4-20
	Correspondence - Client / Consultant / Design Team			
		4.21	Client	
		4.22	Architect	
		4.23	Civil / Structural Engineer	
		4.24	Building Services Engineer	
		4.25	Project Manager / Contract Administrator	
		4.26	CDM Co-ordinator	
		4.27	Quantity Surveyor	
		4.28	Internal Correspondence / Memos	
	Correspondence - SMECon Appointed			
		4.29	Plant	
		4.30	Material Suppliers	
		4.31	LOSC	
		4.32	Sub-Contractors	
		4.33	Consultants	
		4.34	Statutory Authority	
	Correspondence - External Stakeholders			
		4.35	External Stakeholders	

Figure 5.5.10a - Section 4: Site and Technical, from the Build Project Filing Index as of 09/07/08

The problem of the added information required per project – Architect's names, Suppliers' names, etc., had not been evaluated before. This required a further adaption of the system as it had been set up to automatically populate the main structure when a new Project was assigned. The system could not add this new information at the same time, as neither SMEcon or the research team had any way of predetermining what suppliers, subcontractors, would be required for that specific project. This would need to be added ad-

hoc, once the project was running. This led to a complete redesign of the system and its core values.

5.5.11 August 2008

The month of August was mostly taken up with communications on the redesign of the Intranet based upon the previous month's revelations. Also, the month of August is a traditional holiday period and this entitlement was taken by the researcher and NR.

5.5.12 September 2008

As mentioned in July's description of events, a solution was required to fix the new issue. This caused many problems:

- SMEint contact 2 did not have the tacit history of the project, making her understanding of SMEcon's requirements more complicated as details had to be explained from the beginning; there was no existing basis of understanding.
- NR was becoming less patient with the process, causing difficulties with the relationship with SMEint
- Time was now a factor for SMEcon and NR as they had promised a new system to the staff over a year ago

Time was also in the mind of the researcher, as he had planned to begin the process of withdrawal from the active research element of the project, in order to concentrate on completing the 'academic' elements of the work.

These new 'sub, sub folders' required to store the correspondence into the system caused many issue for SMEint, with the researcher and SMEint contact2 and technical staff discussing the options and actions continually for almost 3 weeks. It also added directly to the cost of the system as SMEint were now redesigning the system to suit these additions.

The complications were partially created by one of the golden rules, initially set by NR – namely, that all documents should be in a standard layout/storage facility from the beginning. This was not possible due to the complexities of correspondence coming into the system from outside sources.

NR decided that the trial operation on the one site would stop immediately. This was also due to the pilot user not being able to access the system from his site, leading him to ask 'what was the point?' He was not aware of the correspondence issues with the system itself, as he hadn't managed to connect to it. It was hoped that this would stop any further degrading of the user's view of the system. It had also become apparent that the document saving mechanism wasn't being adhered to. This was partly due to the 'belts and braces'

approach that had agreed to before the launch, where the user would still be required to keep paper copies of everything on site, therefore storing information twice. This was also the first indication that the researcher had that processes within the firm weren't widely known or understood For example, when a site manager receipts a good or service at the site, how does the finance function know to release payment when asked to? What is the process for the payment to be made? The 'triggers' for action weren't standardised. The researcher was very concerned at this, as this should have been done when the document system was first mooted, before this study, when the documents were first identified. NR decided that the Intranet system would be re-launched as soon as possible, with all users coming online.

5.5.13 October 2008

Version 3 of the paper-based system developed, as the decision was made to switch all documents to MS Word 2007. This was mainly due to the amount of new computers now within the firm that had been loaded with MS Vista operating system and MS Office 2007. The researcher carried out this work, whilst beginning to write a user manual for the Intranet system's administration access.

However, MS Office 2007 documents have a different suffix to their predecessors - *.doc* compared to *.docx* for 2007 versions. Unknown to anyone at SMEcon, SMEint, SMEsup2 or the researcher, the latest version of MS Internet Explorer did not support this document type, meaning that no-one could access or save documents into the system.

After many emails and phone calls between all the parties, with SMEint saying it was a SMEsup2 issue and vice versa, the researcher decided, with NR's approval, to switch all SMEcon's computers to use the Firefox, open-source browser, which had no such problems with the MS Office documents. One outcome of this was that NR could now make sure that all SMEcon's staff had the same homepage, the Intranet, as standard. The researcher carried out this task on all the computers at SMEcon.

5.5.14 November 2008

November was a continuation of the work from the previous two months, as there was so much to accomplish. The switch to Firefox was successful but using the intranet as the homepage less so. The Procurement Manager, ISt felt it added another step to his existing processes, as he did not really use the system very often. His work was largely based upon using suppliers' websites for contact, availability and pricing information. The researcher began the of writing the user manual for SMEcon, as the design of the website was now at a

more stable stage, meaning little or no changes to the overall layout of the screens. He also continued the writing of the administration manual, which unfortunately, was changing throughout the month.

5.5.15 December 2008

In spite of December being ‘a short month’ in the construction industry i.e. the last week and a half/two weeks are usually a holiday, the Intranet was re-launched. The system worked exactly as requested and designed. This time, all users were trained in its operation by the researcher, with the aid of the newly produced manual. This worked very well, until one specific question was asked; “How do we know when a document has been uploaded to the system that we need to know about?”

This was not a complete surprise to the researcher, as this discussion had occurred on and off for the last 4 months with NR. It was clear to the researcher in these discussions, that the staff should be active in looking in the system for documents that are necessary to their roles. However, this was not an existing part of the company mind-set and they had depended upon emails, phone calls and faxes arriving to prompt them that an action may be required. When this was obviously not going to happen, the researcher was asked whether the system could send out a reminder to the appropriate users when a document was uploaded. This would be a huge undertaking and when put to NR and SMEint2, the cost, time and technical difficulty with the procured software made it an impossible option.

5.5.16 January 2009

The final training, out on the sites, was completed by the researcher. The sites that could not access the internet were given hard copies of the system i.e. paper-based forms in folders.

The researcher then spent two meeting with another researcher, handing over the system at the stage it was now at, including the administration manual, which had been trialled. NR received all the documents electronically for storage on the SMEcon system.

This ended the researcher’s direct involvement with SMEcon, SMEint and SMEsup2 until the questionnaires in July 2009.

6 Findings

6.1 Introduction

This chapter will explain the findings of the study based upon the two distinct areas; the Action Research (AR) from the beginning of the project until February 2009, and the interviews carried out in July 2009.

6.2 Aims and Objectives of the study.

. The project's objectives were:

- To design and adopt a paper-based standard form library that is based upon desired working processes within SMEcon.
- To apply this model to a newly purchased DMS, including configuration of the DMS's workflow system.
- Adoption, user training and rollout of the DMS across SMEcon.

The overall aim was for SMEcon to have an operational DMS across all users that would create an efficient, standardised workflow model to manage their document processes. This statement was never explicitly made during the project. The aim of the study has also changed completely.

The study will analyse what happened in the SMEcon project with a view to answering why it occurred and what this could mean to wider SME communities. The objectives to meet this aim are:

1. Review of the adoption of a new paper-based form library within a small company and its effects on the business.
2. A review of the overall DMS adoption project and the decisions that lead to it.
3. Extrapolate learnings from review evaluation interviews
4. A comparison of this project's process with other documented studies

These all originated from other work already performed with SMEcon since 2002, as described in Chapter Five, Historical Context. The three key elements in the pre-research work were:

1. NR's historical approach to project implementation through the adoption of Risk Management to his previous organisation,
2. DG and DW's existing ties with SMEcon, and NR in particular,
3. How SMEcon arrived at the point immediately prior to the research study.

All of these elements are important in the way SMEcon and the researcher worked together subsequently. It is the researcher's view that these formed and influenced the relationship and decision making process shared throughout the project. This, allied to the researcher's own experiences, expertise and personality shaped the project fundamentally.

SMEcon's application for research funding gives a great insight to how the project was viewed at that time. It was designed to take the company through the ICT procurement process of investigating, trailing and implementing. It used the basis of the other work, that of the Risk Management system adoption and the Daan Boll reports, to construct the case. This, on first glance, may seem a reasonable approach, as the works do all give some level of experience and knowledge to SMEcon on how to approach the project. However, it did not answer the question of competency: the previous works were completed by knowledgeable people in their fields. NR is a qualified Quantity Surveyor and was at director level in his previous company working on commercial aspects, making him knowledgeable in risk management issues. Dann Boll was a student, looking at construction processes and procedures for his studies, giving him a good knowledge of current issues within those areas. No-one, with the exception of DW, had any obvious experience with ICT adoption.

The relationship between DG, DW and NR can be traced to the work carried out by Daan Bol. However, DG, with other university staff, had also consulted for NR as part of the risk management project before SMEcon existed. The researcher is not aware of any other working relationships between DG and NR before SMEcon, but was aware of their ongoing friendship throughout the research process, mainly through their enjoyment of rugby union. The researcher felt that this may have an impact on his relationship with NR and DG, and ensured he did not politicise any issues, either from his university or company working situations. There were times when this was not easy, as there are circumstances when it is appropriate to describe situations that may not be to someone else's liking. The researcher has taken this into consideration, and will describe some relevant personal views, most of which were highlighted during the interviews carried out at the end of the primary research.

> In terms of practical aims for SMEcon, a fully operational system needs to be designed, developed and implemented, guided by the development of industry- and SMEcon-specific business process models, practices and procedures. In terms of academic objectives the contribution to theory will focus on the development of a framework incorporating: business process design methods and techniques, methods to enable knowledge and collaborative socio-political working within a construction project management context, and a philosophy based on participation and organisational learning. These developments must be sustainable and appropriate for the SMEs which represent the great majority of the Region's (and indeed, the Nation's) construction firms.

Figure 6.2a - Section of original ESPRC Letter from SMEcon

Another issue was the lack of experience in SMEs. Being a director in a large, multi-national organisation, with IT, Human Resource and Procurement departments that specialise in their work cannot be compared to an SME. They may have someone within the ranks who has worked within some environment before but generally, they fill in their knowledge gaps by networking with other small firms or learning enough about the area themselves. However, they rarely become specialised in the field to be aware of other options. In SMEcon's case, no-one had IT adoption experience until the researcher joined the team. It is also very difficult to combine the terminology and requirements of academic practice to the actualities of a live, working environment. The choice of the researcher was critical as they would need to bridge at least some of the identified gaps, as well as perform the study required.

The researcher's experience in IT adoption was with a large organisation and based around the user experience and training roll-out process. He also re-designed the system's training manuals with a colleague in order to make the user learning process a more valid experience. Up until this point, the instruction was based upon the main system's technical manuals, which had no relevance to the actual work-flow carried out by the users. The researcher firmly believes that there is no point in implementing a system if it creates insurmountable or misunderstood barriers preventing its intended performance. The 'translation' of logical systems must suit the users, whose logic may be different due to many other factors but usually the constraints of their environment. The researcher has experienced this lack of working environment awareness often during his working life and finds that it is usually the small details that can overcome the largest problems.

He also had work experience in SMEs. His family have owned a retail establishment for over seventy years, and he worked for a small engineering design, build and installation company for six years. In both of these environments, he experienced IT adoption in one form or another. In the family business, he wrote his undergraduate degree dissertation on the adoption of IT in SMEs, and in the engineering company, he was the new user of the newly adopted Computer Aided Design (CAD) system. These very different experiences gave the researcher other perspectives of IT adoption, critical for the project that SMEcon was about to undertake.

6.3 Reflections on methodological issues

The action research (AR) approach was considered to be the most appropriate for the situation for three reasons:

1. As a small company, SMEcon did not have the resources to assist with an academic study.
2. As a small company, SMEcon did not have the either the personnel or financial resources required to implement the project unaided.
3. In the original ESPRC letter from SMEcon, AR was given as the method which the project would use.

Coghlan (2003: p. 452) states that AR is a method based upon 'a collaborative problem-solving relationship between researcher and client, which aims at both solving a problem and generating new knowledge.' This emphasises the strong relationship between the researcher and the practitioner. It is fundamentally different from, as an extreme, laboratory research, where the interaction between researcher and researched is rigorously minimised by careful design.

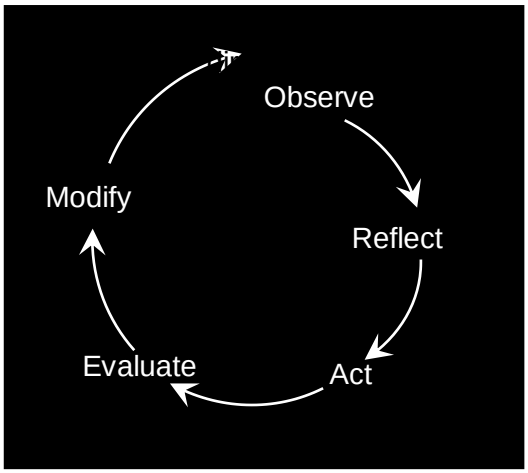

Figure 6.3a - The Action-reflection Cycle (NcNiff & Whitehead, 2006)

The application of AR in the project was planned to be participative. However, the researcher and his team could not fit the project into the model required. As described by Masters (1995), the project was not predictive, especially considering the main decision not to adopt and MIS. It was also difficult to extract any evidence of social change or issues around equity, mainly due to the lack of comparable cases.

The best AR fit belongs to that of collaboration AR, as described below.

Philosophical Base	Mutual - Collaboration Action Research Historical - hermeneutic
The nature of reality	Multiple, constructed, holistic
Problem	Defined in situation
Relationship between the Knower and Known	Interrelated, dialogic
Focus of collaboration theory	Mutual understanding, new theory, inductive
Type of knowledge produced	Descriptive
Change duration	Longer lasting, dependent on individuals
The nature of understanding	Events are understood through active mental work, interactions with external context, transactions between one's mental work and external context
The role of value in research	Value bounded
Purpose of research	Understand what occurs and the meaning people make of phenomena

Figure 6.3b - Action Research, Adapted from Masters (1995)

Due to the lack of any form of control by the research team over the project at key points, most of the study was defined by the situation, rather than influencing it. This has led to a descriptive study taken over a long period. The new aim of the study also reflects this approach as it now seeking to understand what happened during the project and what it means.

However, even this model is not an exact fit to the project. Due to the uniqueness of the project and study, it is not possible to draw from other replica projects and studies in this arena as required by the nature of understanding's external context. Any context used in this study is derived from alternative industries or experiences.

The researchers' role is critical in any study undertaken. The reflexivity, verification and validity of the study are driven by the researcher's approach and reporting of the 'story'. Alvesson and Skoldberg are quoted in Van De Ven (2007) as saying "What is important is that the reflection is adapted to one's own personal abilities, the context of the problem being investigated, and to the perspectives of the stakeholders directly affected by the research project being undertaken."

The researcher found, as the project developed, that he performed different 'roles' as the need arrived. He wasn't only an observer, as many social science researchers are, nor was he the only 'human' component in the experiment, as can be the case in laboratory driven

research. Indeed, some of the roles were conglomerations of activities. For example, he was an observer during the initial SMEcon - SMEsup meeting but was also an advisor and eventual lead for the communications throughout that portion of the project, all while being an academic with the brief of the PHD in his mind.

The following figure represents the overall action research cycles that the researcher undertook, as well as the projects directly before the researcher's employment. They split the project into three distinct areas, which are largely based upon the original aims and objectives of the project. The first three cycles represent the projects that preceded the research itself. These are important as they contextualise the project. Indeed, the Daan Boll project and the Process Mapping exercise were mentioned in the initial report written by DW and DG based upon their investigation with SMEcon. The researcher argues that, due to the timeline involved, the Risk project is also instrumental to the development of the research, as it gave a recent vision of how NR saw the implementation of strategic projects.

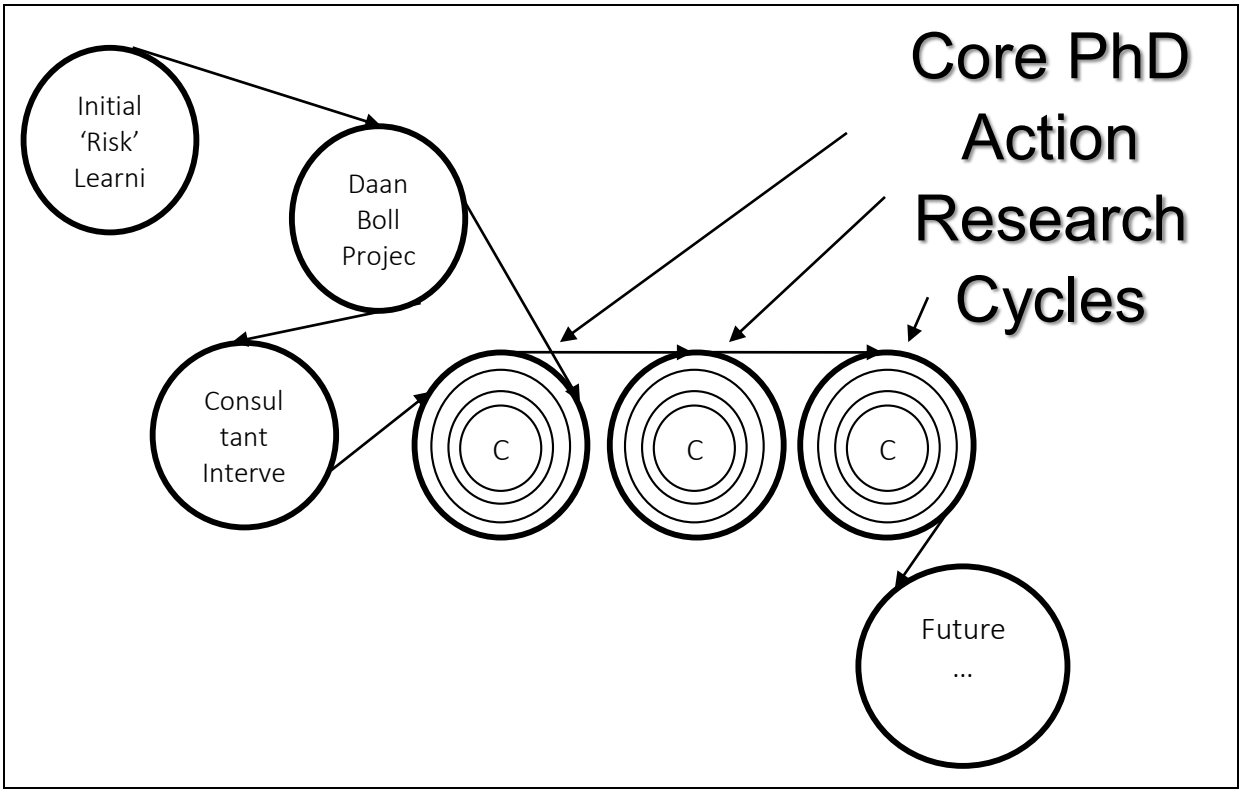

Figure 6.3c Project Action Research Cycles

The three core research action research cycles are represented by three circles (C1, C2 and C3). This is the researcher's 2-d representation of the idea of depth, with the depth implying differing roles that the researcher undertook within each cycle.

6.3.1 Action Research Cycles – Cycle 1

	Description	Researcher Role
	This work entailed the design of the MIS structure in paper form.	
Cycle 1 – Observation	SMEcon had some of the forms they required, mostly based upon those used in previous organisations, but needed them placed into a structure that reflected the 'modus operandi' required by the organisation.	Observer
Cycle 1 – Reflection	The structure was discussed with NR and the researcher. It was decided that the guideline notes, the 'how to' and 'by whom' document, would be created by NR, with the researcher re-ordering and creating the forms in a unique 'corporate style' that itself was agreed on by NR.	Designer – to NR's requirements
Cycle 1 – Action	The researcher created the forms using a mixture of MS Word 2003 and MS Excel 2003. These were chosen as all staff had access to these packages, although newer computers were now being fitted with 2007 versions of the software.	Maker – to NR's requirements
Cycle 1 – Evaluation	The forms were returned to NR via email, where they would then be printed to check for suitability of physical storage (folders). NR and the researcher would check each form, noting any alterations.	Observer – Guardian of the System.
Cycle 1 – Modification	The researcher made the necessary alterations to the forms before a final sign-off from NR and collating them into an electronic folder held on the researcher's computer.	Maker – to NR's requirements
This cycle went through much iteration, as 82 forms were redesigned for V1 of the forms, the initial release of the new system. It was subsequently re-done with V2 (paper version) and again for electronic distribution, albeit in a much reduced timeline.		
Transition 1	The transition from cycle 1 to 2 was not linear as the documents were also revised during and after cycle 2 was completed. Between cycles 1 and 2, the researcher was introduced to the rest of the staff, making him feel more like a team member. This was aided by NR's decision to ask relevant staff members to feedback on Version 1 of the documents that had just been issued.	

Figure 6.3.1a - Cycle 1

Cycle 1, as represented above, was very difficult to achieve; the reasons for which are:

1. There was an eleven week delay in meeting NR after initial research start.
2. The researcher and NR had to work with each other for the first time, as they had only met at the interview. i.e. they needed to begin the working relationship and set the rules.
3. The researcher was expecting to add to the business process work already initialised in a previous project but this was not the case.
4. NR needed the documents that made up the new document system to be "SMEcon'd"; that is they needed standardised to an agreed format, including Company Logo, text style, overall layout and system numbering.
5. Some standardisation had been attempted but required reworking.

Throughout this cycle, the researcher worked with NR only whilst at SMEcon. It was not until the launch of the new document system in its paper form that he was introduced to the rest of the staff. This surprised the researcher, as he thought that elements of the document system not actually operated by NR would need to be checked by those who would be using it day-to-day. However, NR was very assured when discussing the documents and the researcher completed the task to NR's requirements.

At the full staff meeting on Friday 21st September 2007, NR introduced the researcher who then gave a presentation on the new paper-based document system. A full copy of the system was given to all the staff at management level, making 14 copies. This preparation was undertaken by the office manager, IT. The researcher created the documents using MS Word 2003 as this was the software that most of SMEcon's computers had installed. The other, newer computers had MS Office 2007 products which are backward compatible with the 2003 version. During the meeting, NR and the researcher invited comments about the forms, and it was agreed that feedback would be collated through the office manager, IT, and sent to the researcher to discuss with NR should changes be required. Another instruction from NR, was that the new system was to be the only system used as of Monday 24th September 2007. No-one was to use any forms that were not part of this system, with any gaps in the system to be reported immediately to IT. Again, this surprised the researcher, as he was aware of the Dann Boll project that had filtered the document system over a year ago; the purpose of which was to decide which forms were necessary or not. This implied that there should not be any gaps in the system.

Most of the feedback generated was around text-box spacing as the managers tended to fax documents, meaning they wrote larger than they would usually to ensure clarity for the receiver of the fax. This was quickly rectified on the offending forms, with new copies sent out to the staff by the office manager, IT. However, there were gaps reported within the system, mostly from the Health, Safety and Environmental (HSE) Manager, NG. Unknown to NR, or most others, he had two types of HSE reports on a monthly basis; one to be filed in by the site managers and one to be filed by him when he visited sites. When NR and the researcher created the system, we did not know about this double reporting. The researcher checked back into the original forms used, and could not find any evidence of this before. On interviewing NG, he stated that he had always had these forms on his computer and filed them when they were required. The researcher was beginning to be concerned about the usefulness of the process mapping exercise when such a major, and legal requirement had been missed.

The final issue during the feedback was that most of the forms were not relevant to all the managers. Indeed, none of the managers required all of the forms and they felt it was too complicated for them to use. NR and the researcher had been very clear with each other that the system was sufficiently modular that the relevant forms were grouped depending upon the user. The section shown on the following page is from Version 1 of the documents and lists the documents that NR decided would be used mostly by the Site Managers.

4.	**Site & Technical**	
	Inspection and Testing	
4.01	Inspection & Test Plan	**D4-01**
4.02	Inspection & Test Record	**D4-02**
	Project Records	
4.03	Daily Site Diary	**D4-03**
4.04	Goods Received Schedule	**D4-04**
4.05	Plant Hire Schedule	**D4-05**
	Change Control	
4.06	Confirmation of Verbal Instruction	**D4-06**
4.07	Instruction to sub-contractor/consultant/supplier	**D4-07**
	Project meetings	
4.08	Sub-contract Meeting	**D4-08**
4.09	Client Project Report	**D4-09**
	Administration	
4.10	Vacancy Authority/Offer of Employment Details	**D4-10**
4.11	New Starter Form	**D4-11**
4.12	Change of Personal Details	**D4-12**
4.13	Holiday Request Form	**D4-13**
4.14	Self-certification for Absence Form	**D4-14**
4.15	Allocation Sheet	**D4-15**
4.16	Business Mileage Record Form	**D4-16**
4.17	Business Expense Claim Form	**D4-17**
4.18	Petty Cash Record	**D4-18**
	Completion and Post-Construction	
4.19	Customer Feedback	**D4-19**
4.20	Project Review	**D4-20**
	Correspondence – Client / Consultant / Design Team	
4.21	Client	
4.22	Architect	
4.23	Civil / Structural Engineer	
4.24	Building Services Engineer	
4.25	Project Manager / Contract Administrator	
4.26	CDM Co-ordinator	
4.27	Quantity Surveyor	
4.28	Internal Correspondence / Memos	
	Correspondence – Koru Appointed	
4.29	Plant	
4.30	Material Suppliers	
4.31	LOSC	
4.32	Sub-Contractors	
4.33	Consultants	
4.34	Statutory Authority	
	Correspondence – External Stakeholders	
4.35	External Stakeholders	

Figure 6.3.1b SMEcon Document Management System Section4, Version 1

However, other sections of the system also have vital documents that the Site Managers required. For example, Section 1 has the Schedule documents at 1.08 and 1.09, as well as

the Filing Index at 1.10, Section 2 has the Document register at 2.06 and Section 3 has the Project Proposals at 3.05. These documents, and others in later sections, not to mention all of the HSE area at Section 7, are required regularly on site.

1.	**Planning**	
1.01	New Project Information Sheet	**D1-01**
1.02	Construction Commencement Meeting Agenda/Minutes.	**D1-02**
1.03	Project Management Plan	**D1-03**
1.04	Project Programme	**D1-04**
1.05	Requests for Information	**D1-05**
1.06	Information Required Schedule	**D1-06**
1.07	Requisitions	**D1-07**
1.08	Procurement Schedule	**D1-08**
1.09	Sub-contractor, Consultant and Statutory Authority Procurement Schedule	**D1-09**
1.10	Project Filing Index.	**D1-10**
1.11	Project Meeting Agenda/Minutes	**D1-11**
2.	**Design**	
2.01	Professional Indemnity Insurance Record	**D2-01**
2.02	Design Development Chart	d2-02
2.03	Design Team Meeting Agenda/Minutes	**D2-03**
2.04	Design Change Request	d2-04
2.05	Design Change Register	d2-05
2.06	Document Register & Issue Sheet on each project	**D2-06**
2.07	Drawings and documents issued externally will be forwarded under cover of a letter detailing the items being distributed	**D2-07**
2.08	Drawing and Document Control Flow Chart	**D2-08**
3.	**Financial**	
3.01	Project Risk Profile	**D3-01**
3.02	Project Profile Report	**D3-02**
3.03	Elemental Cost Plan	**D3-03**
3.04	Tender Summary	**D3-04**
3.05	Project Proposals	**D3-05**
3.06	Contact Documents	

Figure 6.3.1c - SMEcon Document Management System Sections 1, 2 & 3, Version 1

The AR cycle applied during this phase of the project worked very well, as the researcher and NR worked well together regarding the Observe, Reflect, Act, Evaluate, Modify and Move on phases. The creation of the documents fitted very well with the flow of information easy to manage. Subsequent versions of the system went much quicker, which is to be expected ad both NR and the researcher were used to working together, and many issues were already known.

6.3.2 Action Research Cycles – Cycle 2

It was at this time that the researcher and NR discussed how the new MIS may be able to operate. It became very clear that NR envisioned the adoption of a new system that would store the newly created documents in a central repository, available to all staff no matter their location. The researcher had the following points about this approach:

- By adding the existing documents to a central electronic storage facility would be replicating the existing paper-based, folder system in operation through the company.
- This would not 'add value' to processes.
- This would not be a MIS that allows computer processing and reporting. It would be a Document Management System (DMS)

NR stated that:

- The system would reduce duplication of paper systems between the sites and the office.
- It would ensure everyone was working from the same, shared documents.
- The security of the system would allow SMEcon to ensure that all staff stored documents where they should be.

	Description	Researcher Role
Cycle 2 – Observation	Based upon the newly created and released forms, the ICT system was discussed. The researcher was asked about ideas, and argued for a database derived system, in order to make process efficiencies and remove duplication. NR said he 'wasn't comfortable' with this and wanted to implement a document repository type system, replicating the structure already in place within the firm.	Team member Expert – IS user training
Cycle 2 – Reflection	Thoughts on how to recreate the paper system into an electronic version – the 'golden rules' Primary end-users = Site managers No possibility of document over-writing No possibility of document erasure Simple, 'light-touch' site for identified end-users Automatic numbering system based upon time and date of document upload This is the system everyone will use to store and retrieve all documents.	Team member Guardian of 'golden' rules adoption
Cycle 2 – Action	DW was asked to evaluate the existing IT system with a view to updating/replacing it to suit the requirements.	Team member
Cycle 2 – Evaluation	The system evaluation and recommendation report by DW and DH was submitted in December 2007.	Team member and advisor to DW and DH
Cycle 2 – Modification	The modification in this cycle took an unexpected twist, with NR receiving advice from SMEsup2 regarding SMEnet, which he procured after one meeting involving the researcher and SMEnet's initial contact. The new system did not go through the AR cycle until it's adoption, in Cycle 3	Team member
Transition 2	There was no transition as Cycle 2 stopped.	

Figure 6.3.2a - Cycle 2

NR believed that a more complex MIS, using databases, was a step too far at this time in the company's development. The researcher agreed with the potential benefits of the central repository but did not think that the financial outlay on a 'static system' as the DMS would be, was the most efficient way to go. An Intranet MIS would offer many other facets to the organisation, as well as making the most use of the existing computing and ancillary hardware.

This argument was backed-up with the DW/DH report on the existing computer system and recommendations. They pointed out that the system, with some updates and a few additions, could house an MIS. However, NR had decided that this would be too risky for SMEcon at this time, and wanted a DMS. The recommendations pointed to a system that already existed on SMEcon's servers, MS SharePoint. This could replicate the filing system and store the documents as and when required, without the need for any major investment in other software development. Indeed, it was suggested that the researcher could learn about MS SharePoint and configure the system himself.

Cycle 2 stops at this point due to the decision making of NR, although it could be argued that he did evaluate the options and move on to modifying the brief, thus changing to the next part of Cycle 2. A major motivation in NR's decision is finance. SMEcon had been offered financial assistance if it bought a new 'IT system' from a supplier. Although he does not know the value of this package, the researcher believes it to be substantial in relation to the cost of such a system.

The main issue to come from this cycle was that purportedly commercial considerations were put ahead of the flow of the academic project, which from SMEcon's view, was the way to go. It frustrated the researcher as this seriously affected the work still to be done, both in SMEcon and the research itself. He felt that the major decisions of the system's use, design and procurement were independent of him. He also felt the manner of the procurement was completely unprofessional as there was no tendering process followed. This was remarkable as NR is a commercial director in the building industry, which utilises various tendering processes continually.

The researcher felt, due to DG and NR's friendship, that he could not convey how he felt about the decisions made by NR. DW was very surprised at the decision not to go with MS SharePoint as he understood that this was likely to be the system used since before the research began.

6.3.3 Action Research Cycles – Cycle 3

In the beginning of Cycle 2, he felt that he had a good working relationship in the team, and that this would grow with the project. This was not how he began this cycle. He attacked it similar to Cycle 1, as he was learning a completely new thing in a new environment. This time, he was asked by NR to lead this development and be the key link between him and SMEnet, specifically SMEnet contact 1, as this was where his previous expertise would be best utilised.

	Description	Researcher Role
Cycle 3 – Observation	The researcher received the newly procured product's information to see if it would meet the previously mentioned performance criteria. This was really a fait accompli as the software licences and infrastructure build contracts were already signed, based upon the initial meeting.	Team member
Cycle 3 – Reflection	The researcher felt this was far too quick a decision, especially as no other supplier seemed to have been investigated or contacted. There was also a problem of technological lock-in, as this system was a relatively rarely used Adobe product, ColdFusion, which no-one in the project team had used.	Team member
Cycle 3 – Action	The researcher, through various meetings with the supplier, presented the golden rules for the system and its use, as well as the users it needed to engage. The supplier then developed the system based upon these factors.	Team lead
Cycle 3 – Evaluation	The researcher, along with NR, tested each iteration of the system's development as and when it became available. We provided various feedback ideas, which were discussed in depth and either added or not to the system.	Team lead
Cycle 3 – Modification	Modifications to the visual impact of the system and its operation were communicated through emails with attachments to the development team at SMEsup. These were then investigated and tested by the developers who then made the site available to the researcher and NR. This method of check and change occurred throughout the site's development. The system went through two major modifications due to structural issues with our initial design. These are discussed in Chapter 5. They caused huge problems and delayed the launch on two occasions as well as design difficulties for the supplier. The iterations of these new developments, again, occurred much more quickly than originally planned.	Team lead
Transition 3	This transition was rushed as the researcher had spent too long with SMEcon and needed to focus on the academic side of the PhD. The researcher handed over, via some meetings, all the current files and information to another researcher who had been tasked to tidy up any loose ends after the system's adoption.	

Figure 6.3.3a - Cycle 3

The final cycle of the research section of the project, was fraught with problems, as highlighted earlier. The initial procurement of the new system with its software, development and adoption had been a rushed process taken without due care to some basic information requirements:

1. How does this system compare with others?
2. How is this known?
3. Do SMEcon know how they want the system to work?
4. Would the system do what was required?
5. What happens if the system does not work the way that was required?

Due to the speed of the procurement of the system and as the software was new to the researcher; he had to base his questioning of its abilities on other systems; in this case MS SharePoint. Initially, ColdFusion proved itself to be able to be worked as was required.

The proof of this was supplied by SMEnet with their portfolio of work, which was very impressive. NR and the researcher discussed at length, with SMEnet contact 1, the exacting details as to how we saw the system needing to operate. After a few meetings back and forward between the parties, SMEnet, NR and the researcher were convinced that the system could be built to suit the structure that NR wanted. This structure was fundamentally disagreed with by the researcher as reported earlier.

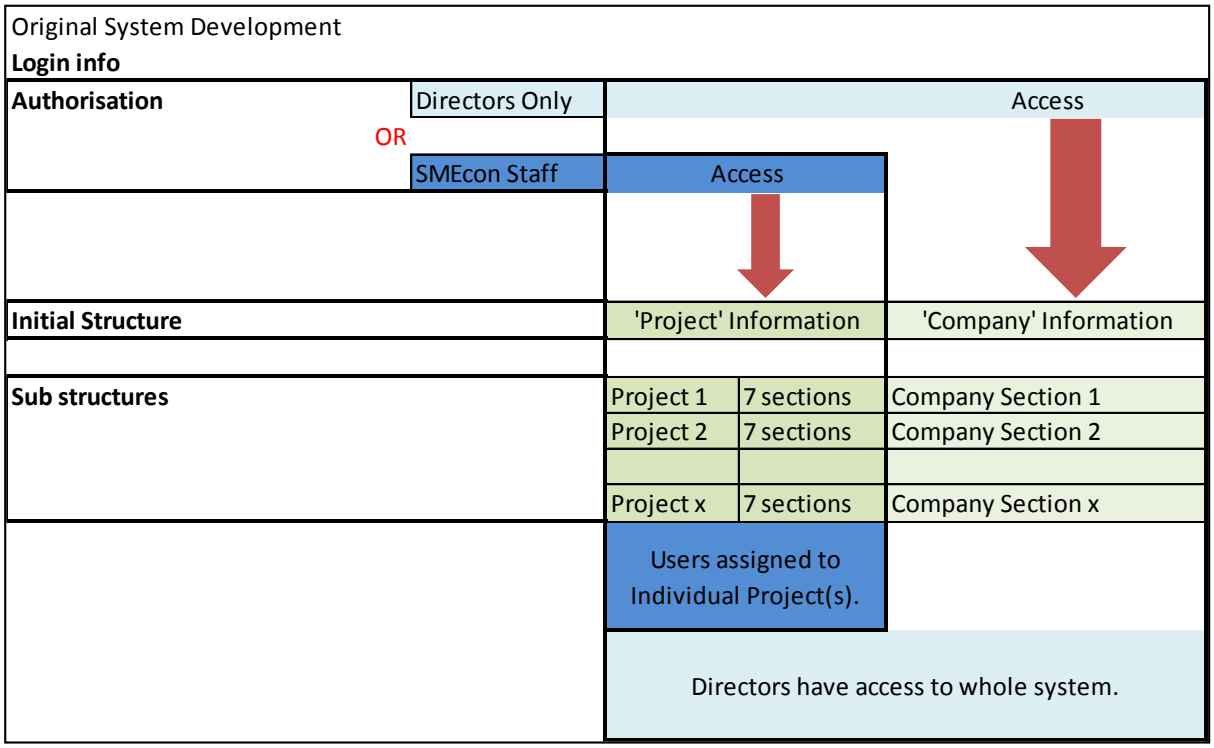

Figure 6.3.3b - Original System Development

The above figure represents the original structure of the DMS as requested by NR. It was a relatively simple design for SMEnet as there were only two levels of security. This was accomplished by the user login process, which would direct the user to their predetermined area of access. Project level staff could access any project that they were assigned to and directors could access all areas. This mechanism was controlled by an administrator, initially the researcher, assigning the person to the appropriate area as designated by NR.

As described previously, when the researcher formally began to place the documents into the new system the reports from each section manager (Procurement, Construction, Business Systems, etc.) could not be placed into the 'Company Information', as the manager would not have access to that area. However, placing them into the Projects domain would mean repetition, as the project managers only see their project. NR then requested that SMEnet create an additional section to cope with the management reporting and access.

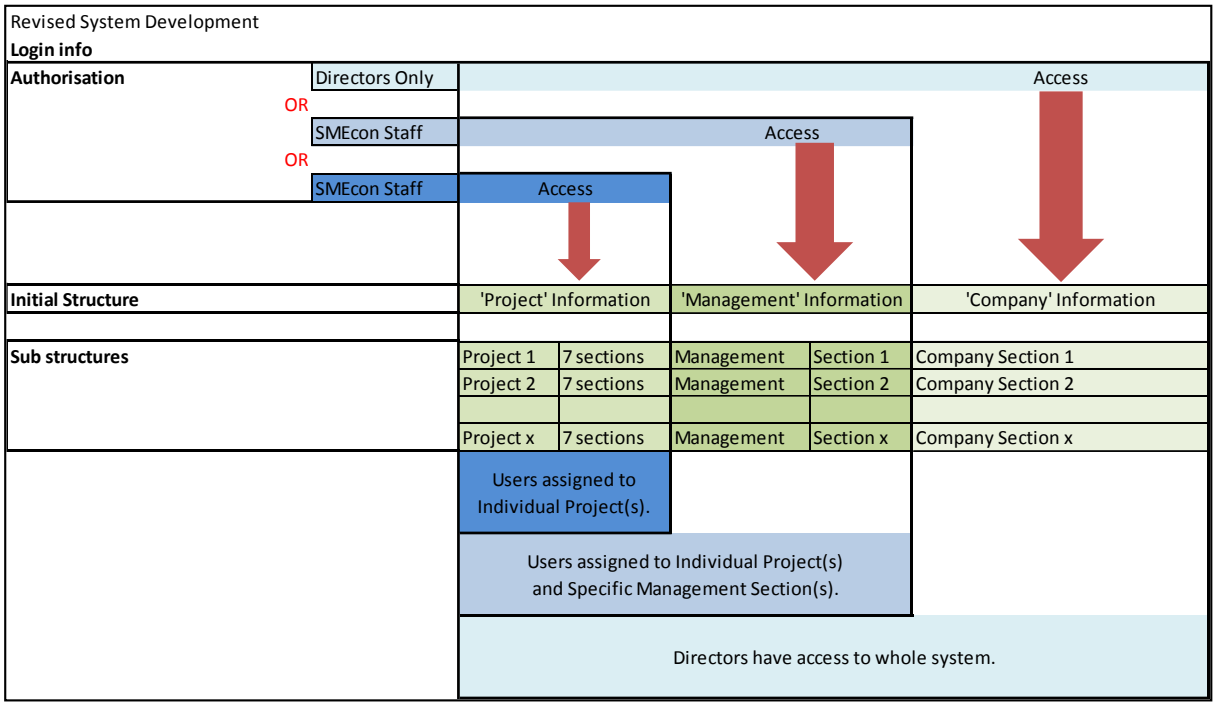

Figure 6.3.3c - Revised System Development

This third level should have been implemented long before the system was designed as the paper document system had numerous forms that could not be easily stored in a two-tier system. This error worried the researcher very much as he was beginning to doubt NR's notions of how a company works day-to-day. However, as time was very much against the project's deadline, he ensured that SMEnet had all the assistance it required in order to meet the launch date.

With the launch of the system, NR had decided to trial the system with a new project that SMEcon had just won. The site manager had a reasonable knowledge of how to operate a computer, and the researcher formally trained him in the new system's use. However, the researcher was required to operate the 'back-door' administration of the system too, as there had been no planning for a SMEcon staff member to be trained in the system at this time. Again, this frustrated the researcher as there is no point in having a system you cannot manage.

Unfortunately, the launch failed. This was due to:

- Interface problems between the manager's new computer and the broadband dongle
- Issues with the structure of the DMS revolving around correspondence storage.

The first issue was not foreseen, as the dongle had been used on other machines without incident and, although much slower than a cabled broadband service, was sufficient for the light design of the DMS interface. The second issue was much more serious.

NR had included a correspondence section into the system but hadn't allowed for the way that the correspondence is used. As a small building firm, almost all communications with clients and suppliers is in a written form, be it letters, faxes, emails, or drawings. A huge amount of communication between architects and suppliers is done through various advice notices. The researcher, not being from a construction background, did not appreciate this factor. It meant that the system needed further levels below the structure already created, to allow each project to add its own customers and suppliers when required. This was a mammoth task, which should have been identified long before any system launch. This alteration had impacts on the whole system design, as well as the added work required to administrate the system in order to add all of these stakeholders per project.

The researcher firmly believes that if Cycle 2 had been completed in a more professional manner, with a selection of solution suppliers, specifically ones with construction industry experience, then the mistakes and issues that occurred in Cycle 3 would not have been so severe. Cycle 3 became a 'fire-fighting' exercise which was uncomfortable for all involved.

In summary, Action Research and the cycles described is a remarkably agile methodology. However, when reading about its design and adoption, researcher's must be aware that the decision making process will not always follow the academic flow, making AR very difficult to manage. There is also that issue of getting too involved in the company and its timeline, rather than that of the academic study, which the researcher was guilty of. However, when

the company is also paying a financial contribution to the research, it is very difficult to remove the researcher from the proceedings, especially if the company's project timeline is slipping, whatever that reason may be.

AR should also not be taken in isolation. The researcher found that merely attempting to follow the methodology was nowhere near enough in order to complete the project. He had to use other skills and schemes in order to provide cohesion to the academic work.

6.4 The Project Evaluation Interviews

The researcher had highlighted research regarding the problems of SMEs and their somewhat unpredictable relationships and experiences with IT suppliers. He stated that there was a need to gain a better understanding of perspectives of all the stakeholders involved , made up of the key actors involved in the IT acquisition and implementation process. In SMEs this can involve mainly the owner managers or directors of the company together with IT technologists (sales and applications developers) from the IT supplier. A structured means of gathering and understanding these diverse and multiple perspectives can be beneficial to maintaining and developing relationships between the stakeholders within the IT acquisition and adoption process. Based on a review of the literature, Orlikowski and Gash (1994), developed a socio-cognitive approach that led to the development of a conceptual framework for examining the interpretations that people develop around technology. Orlikowski and Gash (1994,p 178) define the term technological frame "to identify that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes not only the nature and role of technology itself, but the specific conditions, applications and consequences of that technology in particular contexts". Furthermore, Orlikowski and Gash (1994, p183) advocate using the concept of technological frames to detect levels of congruence within organizations across three distinct domains:

- *Nature of Technology* – refers to people's images of the technology and their understanding of its capabilities and functionality.
- *Technology Strategy* – refers to people's views of why their organization acquired and implemented the technology. It includes their understanding of the motivation or vision behind the adoption decision and its likely value to the organization.
- *Technology in use* – refers to people's understanding of how the technology will be used on a day to day basis and the likely or actual conditions and consequences associated with such use.

It can be seen that the technological frames concept and approach can provide a level of interpretative analysis that may enable a better understanding of how to manage complex

client and IT vendor relationships. This research study adopts the technological frames approach, from Orlikowski and Gash (1994), to make sense of the sometimes incongruent and conflicting perspectives influencing the conduct and outcome of the electronic document control and management information system.

In order to investigate SMEcon's post adoption results, the researcher reviewed the SCOT literature to ensure that the structured questionnaire would answer the pertinent areas of concern. He wanted to get and insight on the three core areas of the methodological framework:

- Does the 'technological artefact' have different meanings and interpretations for various stakeholders? The technological artefact was split into two, the 'MIS' and the ICT as the researcher wanted to know if people perceived there to be a difference between the two. Originally, this shifted the focus for the explanation of scientific developments from the natural world to the social world. In this case, the researcher applied this focus shifting idea from the specific working environment of what MIS and ICTs were to that of a more 'socially' accepted one. It was argued that although interpretative flexibility can be recovered, it soon disappears in science; that is, a scientific consensus as to what the "truth" is usually emerges.
- Had the description of the artefact been stabilised? Closure in technology involves the stabilisation of an artefact and the removal of any problems.
- Rhetorical Closure is that the closure of a technological "controversy," need not actually solve the problem. It only requires the relevant social groups to see that the problem has been solved
- Closure by Redefinition of the Problem is much more complicated, in that it solves one problem, by inventing another, which is then solved.

The third stage attempts to relate such "closure mechanisms" to the wider social-cultural milieu. The researcher, based upon the conversations during the interviews, attempted to glean a contextual, social discussion where the subjects were asked to relate their experiences with the artefacts' adoption to their own overall experiences, whether in previous work or home life. This socialisation, once identified, should alter the subject's ideas of the artefacts.

The first section of the questionnaire, shown below, dealt with focusing the interviewee's answers to the specific system. The first question provides a quantitative response, which was then enhanced by asking about the interviewee's reasoning and finally, asking about specific examples.

No.	Main Question	Supplimentary Questions	Reply	Supplimentary Information	Question Purpose
1	Are you using 'the kist ?				Simple – perform check on actual knowledge and use of the system. No positive or negative views required.
a		Why?			
b		Specifics? (Proof?)			

Figure 6.4a - Question 1

The next section specifically investigated the interviewee's knowledge of what an MIS was. The researcher decided to stay with the term MIS, as this was the original plan of the project. He felt that DMS would not be as recognisable to people out with the IS field. It goes on to question whether they understand its function, and ask what their assumptions about its adoption were before it arrived and whether it met their expectations' once adopted.

2	What is an MIS ?				Issue? – Knowledge of an MIS – do they have an 'understanding' of what it is. What is this understanding? Is it common to the stakeholder group?		
3	Have you ever used an MIS before				Their story. Based upon their understanding of an MIS. Past experiences, 'top 3 'events/situations? "		
a		Where?					
b		When?					
c		How?					
d		Specifics? – Training, explanation of company 'vision'? usefulness, etc.					
4	MIS						
System	Role – MIS's in general				What should/does/can the MIS do? What job should/does/can it fulfil?		
	Importance – MIS's in general, then specifically				Is it important	A) to the organisation? In what way?	B) to you? In What way?
	Context – MIS in your work				Relationships to – other systems? People?, Organisations?		
	Purpose – MIS in your work				Does the MIS meet its purpose, based upon the previous points?		
		Assumptions	Expectations	Knowledge			
		People					
		= Nature of System, which refers to people's images of the system and their understanding of its capabilities and functionality.	= System Strategy, which refers to people's views of why their organization acquired and implemented the system. It includes their understanding of the motivation or vision behind the adoption decision, and its likely value to the organization.	= System-in-Use, which refers to people's understanding of how the system will be used on a day-to-day basis, and the likely or actual conditions and consequences associated with such use.			

Figure 6.4b – Questions 2, 3 & 4

These questions were then asked about ICT, in the same manner, as shown on the following page.

5	What is ICT ?				Issue? – Knowledge of ICT – do they have an 'understanding' of what it is. What is this understanding? Is it common to the stakeholder group?		
6	Have you ever used ICT before				Their story. Based upon their understanding of ICT. Past experiences, 'top 3 'events/situations? "		
a	Where?						
b	When?						
c	How?						
d	Specifics?						
7	ICT?						
System	Role – ICT's in general				What should/does/can the ICT do? What job should/does/can it fulfil?		
System	Importance – ICT's in general, then specifically				Is it important	A) to the organisation? In what way?	B) to you? In What way?
System	Context – ICT in your work				Relationships to – other systems? People?, Organisations?		
System	Purpose – ICT in your work				Does the ICT meet its purpose, based upon the previous points?		
		Assumptions	Expectations	Knowledge			
		People					
		= Nature of System, which refers to people's images of the system and their understanding of its capabilities and functionality.	= System Strategy, which refers to people's views of why their organization acquired and implemented the system. It includes their understanding of the motivation or vision behind the adoption decision, and its likely value to the organization.	= System-in-Use, which refers to people's understanding of how the system will be used on a day-to-day basis, and the likely or actual conditions and consequences associated with such use.			

Figure 6.4c – Questions 5, 6 & 7

The big issue with asking these types of questions is that, once asked, the interviewees may now have a slightly different response compared a one-off, matter-of-fact question by someone better known to them. The researcher, by asking the questions, has impacted upon the interviewees' responses. To try to mitigate this problem, the researcher kept the discussion going and asked about more personal experiences with systems and ICT, with the aim of depolarising the employees' answers to tell what answers they felt may have been expected.

The final section asked the interviewees about their impressions of how useful the two artefacts were, or whether they were not necessary at all. Depending upon the employee's reply, not all of the section would need to be filled.

			MIS	ICT	1	2	3	4
8	Hindrance – due to 'time consumptions, onerous-ness, difficulty				Is the MIS a hindrance to your day-to-day work?	Is the ICT a hindrance to you Day-to-day work?	Is the overall system – ICT & MIS a hindrance to your work	Is it a hindrance to others you work with?
a		Examples						
b		What do you think would improve it? (Required to fix it?)						
c		Can it be fixed?						
d		Can YOU fix it? – Would you?						
e		Examples						
9	Harmless – No significant effect workflow or accuracy				Is the MIS harmless to your day-to-day work?	Is the ICT harmless to you Day-to-day work?	Is the overall system – ICT & MIS harmless to your work	Is it a harmless to others you work with?
a		Examples						
b		What do you think would improve it? Required to fix it?						
c		Can it be fixed?						
d		Can YOU fix it? – Would you?						
e		Is it worth fixing?						
f		Examples						
10	Essential – In order to complete the task				Is the MIS essential to your day-to-day work?	Is the ICT essential to you Day-to-day work?	Is the overall system – ICT & MIS essential to your work	Is it essential to others you work with?
a		Examples						
b		What do you think would improve it? Required to fix it?						
c		Can it be fixed?						
d		Can YOU fix it? – Would you?						
e		Examples						

Figure 6.4d – Questions 8, 9 & 10

6.4.1 Do you use the Kist?

The first question was quantitative, with a simple answer of yes or no required. However, the responses were more varied, possibly due to the worry of the interviewees that they were being checked up on. Once they were reassured by the researcher that this was not the case, and this was a study into people's use and understanding of the system, their answers began to fit the expected formats.

Out of the nine staff, not including the directors, four were not using the system at all, two members were using it, and the final three were using it in part, mainly due to access and operability issues. Remembering that the researcher had exited the company and these interviews were being held in July 2009, some five months later, it seemed astonishing that the take-up of the system was not total. Surely, even the access issues could have been dealt with in that timescale. The subsequent questions in this section qualified the initial replies.

Who	Access	Usefulness	Incumbent system/duplication
Project Manager	"I would use the Kist if I had internet access."	"But if I'm in the office I would most often or not I would download forms off the Kist."	
Architect		"I haven't had any projects, relevant projects on site that would have required it in my view and since it was introduced there's actually been a little bit downturn in (business) we expected some projects on site that haven't happened where we would have used it probably."	"Not that I think they would ever have been used by site, perhaps only if anybody in the organisation or in the office wanted to look at the drawings without having to go and look for a print. I don't think that it's any use on site. You pick a paper copy out on site and you use it on site. You can't take a laptop out with you and show the bricklayer or somebody... they all use paper copies and that will always be the way but if anybody else needs these drawings from wherever they are then I suppose it might be useful for that."
Procurement Manager		"It tends to be more or less just printing standard documents off, copy requisition or copy of my timesheets. I use it for plant records - that is actually a role on the Kist, and also pricelists, I've got them up and running on Kist so I do use it a bit but they're just viewed now and again when I need to."	"No. Well yes I would say at least 95% of our work is done on the old system, Pegasus. I do use the Kist for standard documents but there's not much call for me to upload onto Kist.
Finance Manager		"Only because I don't need information on the Kist if you know what I mean, because it's got other sources to give me it. standard documents, they get them all down there and they provide it to me. I don't necessarily go on there to get anything off because I don't have to fill out forms as such or send the documents. I could use information rather	

		than the Kist. I get it from them."	

Figure 6.4.1a - Follow up questions and replies 1

Only one person, the Project Manager, noted his lack of access to the system. When pressed about his attempts at using the system to download the standard forms, he justified the 'lack of uploading' issue: "Uploading not so much, as I'm spending most of my time on site and I don't have access to it so I can only do it when I'm in the office, which isn't enough time. But I think if I did do something I would upload it so I think it's a good system but I don't think they're using it as much as they should do."

The Procurement Manager also made reference to the speed of use of the system when the researcher asked specifically about the use of his monthly management reports: "The truth of that is that they on the Z drive..... I might be wrong but it's quicker than the Kist."

The two users who did use the Kist, the site manager and the estimating manager, used the system regularly. However, even in these instances, when pressed, they admitted to not using the system fully.

"I do use the Kist for downloading forms and everything, you know I do use it in that respect. Everything in the Kist, everything is put on to it by my manager so that he knows if I sent a requisition in. I used to send a requisition in to the office and I would CC (carbon copy) him in and then he would put it as far as I'm aware into the Kist."

This seemed strange to the researcher that the site manager's manager, who was the overall Project Manager, assigned due to specific contractual arrangements, was using the system continually. If there was such an amount of use, surely an administrator or assistant would be a more cost-effective staff member. The estimating manager had his own issues too.

> *"Well the only items I use it for is as estimating manager I've prepared two reports, and the estimating register, which is a document that I've got saved on Z drive. It gets updated every week and once a week I send it up to the KIST so there's a record of tenders received etc. etc., so it's an ongoing list that's updated weekly and saved. I also do, once a month, a bid and management report, which just charts the ins and outs of tenders received, tenders submitted successfully, etc., etc., and again that's once a month forms filled in and it's uploaded on the KIST."*

It appears that, although registers are used almost daily, they are centrally stored on the system once a week. This was not the plan devised by NR. Another issue arose with the estimating manager:

"The only other use I've had of the KIST is downloading forms, basically the forms I've used are subcontractor's enquiry sheet and materials enquiry sheet and once it's been downloaded once the form is protected anyway and I just tend to use it from the previous jobs. So I don't specifically go in to there because a lot of the jobs we've had recently have been from the same subcontractor. So when you're typing things in, and I'm a firm believer I'm not going to start from scratch. If it's there and obviously you've got to be careful when you're using something that you've used before and I don't like the idea of cutting and pasting stuff, people doing it for speed.... but I'm using one at the moment and I just tend to check everything in the limited time I've got which obviously tending your workload and stuff I'm looking for the easiest and quickest way to use my time. I can't see any other uses."

This statement was a revelation. This manager re-used existing forms, with the appropriate addresses, to save on typing and retyping information request to his suppliers. This was not planned for with the Kist. The final argument from the manager was even more revealing about the structure and organisation of the firm as a whole, and has been kept as per the conversation that was transcribed.

Researcher: "You're in charge of your section of that part of KIST, so you using one form off the KIST and then using it repeatedly. Then you'll know when you update the form rather than using the Kist to check for the latest standard form"
Estimating Manager: "Yes. It's a process. Now NRs gone to the trouble of looking at the form standards, it'll be sent to KIST."
Researcher: "You might not know that there is new one (form) on the KIST. If it is updated, there's the danger of you still using the old one.
Estimating Manager: "Well I hope there would be a system in place for somebody to send an e-mail or some correspondence round just to say this is the new form and you've got to use it. At briefings and monthly meetings and team meetings, etc., etc., you've got to be responsible for filtering some information down otherwise it becomes a different format so if you're just going to sit on it and not act on it well you're not doing your job are you? There's got to be a system on place to sort it."

Figure 6.4.1b Transcription 1

This was an astonishing revelation to the researcher. The DMS, the Kist, was meant to be the central repository of all standard forms yet no-one seemed to have grasped this, and were continually working around the system, in this case, by regurgitating used forms to save time on typing.

The final three people claimed to be using the system 'in part'. The researcher would add the two employees mentioned above in this statistical group, but as they claimed to be using it fully, it is not appropriate to alter the given responses.

Who	Access	Usefulness	Incumbent system/duplication
Construction Manager	"Yes and No. It's fair I haven't been able to use it for the last three weeks because of a password programme. Anyway	"I mainly use it myself for downloading our standard documentations for whatever, whether it's pre-start meetings, whether it's	"For the Sites - I also keep a copy myself not in the Kist but for record purposes. It's a case of what you reported and

	SMEnet, whatever they call her, sent me that back yesterday afternoon so I'm able now to get..... So I've had a little bit of a lull."	sheets for information or whatever. The only things I'm uploading really is programmes, programme of works and progress reports."	when you reported it just in case you need to go back to a bit of history to see what was said at that meeting and the client had."
HSE Manager	"Well. to be perfectly honest I'm using it in part." As I say at the moment it's not stand-alone where I still use my documents and file stuff on my documents simply because when I work from home if I'm on the shared drive my machine will not load when I'm going from one document to another, it's taking half an hour to open up a page which is really no good.	"A while ago, because my reports, the site safety reports that I do which are my reports because there is site safety inspection forms. To give an example, I was doing a site inspection; I would load it onto their Kist so that they had access to it which I felt was the right thing to do... I know it's my form but NR said no it should go into the management, you're management section okay, but then nobody has access to it except me. I couldn't see the logic in that to be quite honest. I'm not being critical I'm just making a statement of what I feel about it. So again I think that should go.... you know what I mean that goes to all the sites and they should have access to my form. I mean it's theirs really. But the only problem with it of course as well is I've started off with 100 forms and there's only 25 there but of course these things take time. It's just I couldn't function wholly on the Kist, let's put it that way. I mean the system's there and it's good and it could..... it does work, only it's the amount of information that's there."	"What I do is I put it on my documents and then I can work easily with that and then I transfer it over to the shared drive but even then what I found difficult with the Kist is where do you put stuff? Is there a section there that would be suitable for one? I want to go on there, so consequently I don't put everything that I've got onto the Kist."
Office Manager	"I really have time issues where it takes to upload documents and uploading photographs is just ridiculous, the fact that you can't have things at the minute, although I'm being told you can, but we can't at the minute create	"To put minutes on, to put occasional letters that I will do, and virtually daily for the drawing register. I've just been on it about 20minutes ago to add new drawings. I will use the management sections for admin reports and	"The other day I did some pre-start minutes on it and with the ? KIST and he went oh alright can we have a hard copy. I said no, I said one hard copy to the central file, ?? So how would people know who have just started and

	sub subfolders and I'm aware that it exists but I've had no training on it and I've been asked the question. At this point in time, until I get that training I can't show anybody else how to do sub-subfolders which is one of the reasons why the surveyors don't use it because they can't break things down into the folders."	anything other than that gets done sort of as and when, because it isn't divided into subfolders yet, and anything not put on to the Z drive and the clerical sections, say 75% of how we work. I use it for standard documents, to download to various people or to fax to those who don't have laptops."	they've been at a meeting (both talking) well what I did and I kicked myself for doing it, I sent an e-mail to all the people who were involved and said this document has now been uploaded on to the KIST, please view, and I was really cross with myself because I thought I can't possibly do this every time, so you're doing a hard copy."

Figure 6.4.1c - System usefulness replies

The Office Manager was very animated about the issues around the system. She also pointed out that she was responsible for all 'back-end' system operations, which required a lot more time due to the various reconfigurations of the system in its development and launches.

> *"This is probably the only feedback you'll get from me because I'm the only one who is really trying to get away and use it and if I can get away and use it then I can pass it down the line and try and encourage but I'm finding that I'm getting so negative about it that I just really really am frustrated with it because I can't give somebody the right answer....I just feel like I'm running and running and running to keep up."*

When the researcher asked why other staff were not taking responsibility for their section of the system, she provided an example of an issue.

> *"It's too easy for them to say well 'you haven't put sub-contract orders on'. MK had put them on, but if somebody rang me or he wasn't here and I needed to do it, the first thing I would do is I would look on the Kist and, right there's nothing there, right so it's either on his C drive, has he put something on the Z drive, or hopefully there's a hard copy in the file. Now I accept that I should perhaps look in two places for something, one electronic and one hard, but not four!"*

This frustration pointed to an area that the researcher thought had been addressed before the research started; does everyone know their place in the process and what triggers there are to move work along? It seemed that everyone was just plodding along doing what they needed to do, without any consideration to what others may need from them.

The second main section of the questionnaire dealt with the staffs' understanding of an MIS. Obviously, the Kist was not an MIS, but a DMS. However, the phrase DMS is not as well known to those outside the IS field, and the researcher felt that this may add another level of communication difficulty that was not appropriate at this time.

The researcher did not coach any interviewee in this questionnaire and, as such, feels the language used by the respondents is vital in understanding their assumptions, observations and knowledge on the subjects queried. The responses will be listed in the same order as the previous section.

6.4.2 What is an MIS?

The Project Manager's idea of an MIS was

> *like a social centre where everything should be in a central unit where you can find information where information is shared about where to go to for information and I think a lot of companies actually have them now. It's like having internet systems cut down and having to be everywhere at one time and you could just go to one central location to get what you need for that project.*

This was similar to the structure that the Procurement Manager described.

> *Somewhere where all management information is stored, like a library as such or somewhere you can get I'd say a folder where if you want to get access to the management information that's where you get it from or..... I'm saying a folder, well obviously if you're on a PC a folder like somewhere it would be saved.*

They are both recalling their experiences of information storage based upon their previous experiences of it. Project Manager's experiences of MIS were based upon the system used for his university course, whereas the Procurement Manager worked for another construction company where the MIS was

> *"it was just where you kept your standard documents, it was all kept on a server and you used to go in and download the information you needed." Neither system was directly labelled as an MIS."*

The Architect's response was initially surprising to the researcher, as he had assumed that, as a fellow draughtsman, he would have accessed some sort of system to manage his drawings and related information.

> *"I've never given it any thought because it's never arisen. I'm not particularly interested in management and how our companies are run. I'm here to do a job and I do what I'm told and I do it to the best of my ability. I've never really had any particular interest in management systems so I wouldn't really know what a management system is per se because I'm not that interested in it. I suppose the filing system where we store things within the company then that management information system."*

The Finance Manager's responses were the opposite to the Architect's. This, the researcher found, was an interesting comparison of the stereotypical architect's approach, dealing with form, aesthetics, etc., to that of an accountant, dealing with facts and figures on spreadsheets.

"A management information should be basically about storage, retrieval and that's it really, storage and retrieval I would have thought. Any information within a company or any information at all. Any sub-set of people, information, data, ... information interchangeably within that kind of a premise."

He went on

"I think everybody uses it in everyday life, whether they realise it or not. I've used similar systems before – internet, intranet, just normal kind of database drives and similar kind of thing but most times they weren't classed as management information systems, you know but obviously they weren't labelled or branded that way. In my previous company where it was lots of different centres had lots of input and I would take care of information and put back results based on collation and that sort of thing and they would go away using that and make decisions."

Due to the nature and structure of the questions, not all the areas could be answered in the form as designed, mainly due to the researcher's approach that the interviewees should not be coached or led to a specific point. He wanted to allow the respondents their own space to answer the questions from which the appropriate replies could be extrapolated.

	Role – MIS's in general			
	Importance – MIS's in general, then specifically	Finance Lead - Basically because directors have to make decisions and if their information is disjointed or they don't have the full picture or one person is doing one thing and another person's doing another thing they can't see like for like comparisons, so they just can't make proper decisions on information. So if you've got a central storage, it's just one, it's not duplicated, it's not missing, it's as complete as complete can be, they can make the best decisions and I'm assuming that's why anybody makes any system		
System	Context – MIS in SMEcon – your work	Project Manager - I did know what it was because similar companies had similar systems. Obviously	Procurement Manager - Well before it came on board I thought it would be a lot quicker and easier to use.	Project Manager - I thought it was very simple, which is good. Sometimes you want to keep things simple

		your larger companies have it. The smaller companies however I think just normally have a shared drive, they don't really have anything that we do, I don't think.	Easier to use in but obviously there's problems behind that which obviously you'll probably come on to in one of the other questions. Finance Lead - it's a brilliant idea in how it was..... I just don't think it's quite right for us or quite right for certain members of us. The whole idea of it is so everybody can access it, but half the people that I think it was designed for can't use it because they don't type or they can't get access to it.	because you've got a lot of older people in construction. It could be more thorough I guess, have a bit more information but I think it needs to be used more. There's lots of paperwork everywhere which the system is supposed to stop that and so it's not doing what it's supposed to be doing which is shame because I think it's much better having a central file.
	Purpose – MIS in SMEcon – your work		Architect - You must have had a limited number of places where you could file that piece of paper whereas now to look at our system, if you look at the menu and the folders and sub folders and sub sub folders you could probably file that piece of paper in 50 different places...	Finance Lead – It makes the whole system pointless if those people I think it was generally designed for can't use it.
		Assumptions	Expectations	Knowledge
		People		

Figure 6.4.2a – MIS replies 1

The responses above were enlightening. It could be argued that these users, who admitted to not using the system, maybe tried to sabotage its implementation, either intentionally or not. However, what appears is that these users did have an idea about the system's potential and had very clear ideas as to why it did not work the way it was planned to.

System	Role – MIS's in general			
	Importance – MIS's in general, then specifically			

	Context – MIS in SMEcon – your work	Estimating Manager - I think NR showed us the hard copy of the forms that are in there, obviously they looked like forms I was familiar with in another company and the bit that I was having to use again was very limited in stuff like that. "	Estimating Manager - I did foresee problems, not necessarily with my discipline but other disciplines. Right idea but I think it's very difficult to keep information up to date and the danger of that is you're using it as somebody on site basically drawing down a drawing for instance and it hasn't been updated by the person in here	Estimating Manager - One thing the Kist does.... other systems like draw down, they weren't particularly saving the information back to a central point if you like, they were all about reporting into hard copies or electronic copies, put on your shared drive after that. To be honest I can't ever see that working in my discipline because there's that much information that I would spend that much time uploading it and by the time I uploaded it, it would be out of date ...it's impractical to be sending information up there every... at the end of every day. You just wouldn't get any pricing done.
	Purpose – MIS in SMEcon – your work			
		Assumptions	Expectations	Knowledge
		People		

Figure 6.4.2b – MIS replies 2

The staff who answered yes to using the system, had very little to say about their assumption, expectations and knowledge, apart from the Procurement Manager, who had recently joined SMEcon form a larger construction company. He was able to make the distinction between his assumptions, expectations and actual knowledge after the fact, one of the few who did.

System	Role – MIS's in general			
	Importance – MIS's in general, then specifically			
	Context – MIS in SMEcon – your work	Office Manager - My initial reaction when the Kist was being mentioned I realised it was going to be this		HSE Manager - We're in a small company here. I've worked with the three directors but they've come up from

		thing and I thought it would be a company planned thing which is how I have a company		a national company background. NR in particular is a systems and procedures man you know and it's quite evident in the way he's promoting the company and the systems that we've got in place and that's fine, I've nothing against that. I've been brought up in that environment as well but this company..... it doesn't lend itself to this company.
	Purpose – MIS in SMEcon – your work	Construction Manager - Well over the last 3 – 5 years I'm just starting to pick up with the IT in computers so I didn't really know what I was going to have in front of me. I kept getting told it's going to improve the system and make it easier to access and certainly much quicker.	Construction Manager - Well they've been talking about this during the course of you putting it together... as far as I'm aware... they're a new company, newish company and they wanted to when they go into meet clients or whatever to be able to say they have this system or whatever as part and parcel of the company and it would help in the marketing. That's what I think. I'm not saying that was the reason for it but it certainly wouldn't do any harm to say we have our own system here and everything is stored on what we call the Kist and you know.....	Construction Manager - You know until I actually have a go and I don't profess to be that brilliant at it, I do have a go at it but to answer your question I don't know what I expected, all I was doing was picking up bits and pieces from other people who were more conversant with IT than what I am. Having said that and I've got to be upfront and honest about this I personally don't see the advantage the Kist has other than say for example the Zdrive would have, it's storing information and we have that. .
		Assumptions	Expectations	Knowledge
		People		

Figure 6.4.2c – MIS replies 3

The 3 remaining staff members also had ideas of what the system would be. Interestingly, the HSE Manager, who noted that he had worked for SMEcon's directors before, stated that the system may also be a marketing tool, in order to differentiate SMEcon form other similar firms.

6.4.3 What is ICT?

The researcher deliberately asked this question after querying respondents' notions of MIS, as he did not want them to get involved with the technical issues that seemed to be apparent, thus not answering the MIS questions appropriately. It also enhanced some of the speed observations made earlier. Again, the researcher has ordered the respondents as per their initial answers to the first question.

The Project Manager, Procurement Manager and Architect all used the terms computers, email and mobile phones when asked what they thought ICT was. The Project Manager, the youngest staff member is South African, and used the phrase 'Cell Phone', which is more commonly associated with North America terminology. He also remembered the time before emails, where facsimiles, or faxes, were the quickest form of written communication across distances. The Procurement Manager also mentioned Pagers but stated that "obviously mobile phones make life a lot easier."

The Architect highlighted his experiences of using projectors when required and discussed his lack of formal training on any text-based software, such as MS PowerPoint and Word. "I just picked it up as you went along. I did do a City and Guilds on AutoCAD, because I was sort of working on it every day in the office and then you learn various functions. That was the only type of training I ever had on any sort of software." He went on to give his observation of how ICT came to him.

> *"When I first started switching from the drawing board to the computer it was only for the purposes of using cad and then I think everything else starting coming with it, like word processing. Before if I wanted a letter, I would have to write it and take it to the typing pool and somebody would type it and I would get the hard copy back and duplicates. But everybody's typing their own letters these days so it's done away with the typing pool. If CAD had never been invented we probably wouldn't have started using the computer or not for a long time."*

This gives a clear view of how the Architect, who uses sophisticated and expensive software daily, sees technology in his work life.

The final respondent to answer no to using the system was the Finance Lead. He has a very specific outlook on ICT.

> *"To be honest, ICT is not for small companies, I don't think it is anyway. It's still information technology, information systems and information management as I see it. Being an accountant that's what I see because that's what I'm taught currently at the moment is kind of split into three but I would see it as one and maybe that's what ICT is trying to achieve I don't know but for me I don't think it's working in the business world as such. I'd never heard it until my partner; she teaches it so maybe it might start coming into being when those generations start coming into the business world*

and they start throwing ICT around. It's one of those things it depends on who you talk to. I don't think it has a boundary. I mean for me I would use all three terms interchangeably and maybe ICT is trying to bring them altogether instead of saying IT and IS and IM but for me information technology is just information and the technology that is used to get it around storing the documents, music or whatever. So I think IT is a more comfortable term to be honest, I think that's just what it should be used."

The two staff members who responded yes to using the system gave very different answers to the question what is ICT.

Site Manager 2 - Information technology to me is ensuring all information is at hand. It's the information that you receive and that everyone has to receive. You're meant to be part of the one circle to ensure that you're all getting the same information. Computers are yes. I mean I read all the e-mails that are sent. If I send an e-mail to someone it goes, it's sent and the project manager is CC'd in or whoever. At the moment we've got 2 computers; me who's got the printer for scanning in and out. We have got the facility up here, the Project Manager has too but he hasn't got the internet so that's a bit complicated. If I do something, the Construction Manager will send me an e-mail, it gets answered and I send it back. I've been in the game a long, long time and I wouldn't exactly say I am fully computer literate, I'm not. I have done my job for years with faxes, paper but I do find the computer is where you alter a requisition for materials and I can talk..... if I fax something.. I used to always get a fax, put my order with it what was sent and you ended up with a ream of paper, whereas now we can go and send an e-mail, reference the Procurement Manager, you know if it's his you have to file, he's got a file and he's either e-mailed you to say there's a problem or I've e-mailed back, e-mailed me for further information or I'll e-mail him the requisition or it could be one of the other managers that have sent their requisition in.
Estimating Manager - I would imagine it's the updated technology that sends things by intranet, internet, e-mail, from the things to PDFs, sending enquiries out in a different format, using new technologies. I didn't start computers until 20 years ago. But I'm always looking to try and do things better, especially in my job it's speed at its essence, I can't see the point of photocopying, sending things to printers etc. etc. I can see drawbacks in things like that, in records and stuff like that but I embrace anything that comes.

Figure 6.4.3a – ICT replies 1

These two users have very different computer experiences. The researcher believes that is more to do with their respective working environments, where the Procurement Manager has been office-based and Site Manager 2 out on sites.

The final group, who partly used the system also have varying experiences of what ICT is to them. Again, the researcher believes their past working environments have had an impact on this.

The Construction Manager's answer to what is ICT was "Computer skills", the first only time anyone implied that ability had anything to do with technology. He supplemented this with "I think IT skills means computer working. Well basically I would think anything to do with computers is IT, technology." The researcher asked when the Construction Manager had become aware of using ICT.

> *"You see when I was doing this I've always had a secretary, right, not an (office manager), you know somebody who was between me and another manager, and this girl would do everything that we needed. We would just write something out and that's done, all the emails just hand over and tell where you wanted it done and when I moved to another company, they didn't have anything like that so you start from scratch. I was given a laptop and it was a case of somebody showing me how to use it just standing over my shoulder, do this, do this and that was it. I've never ever sat down with anybody you know it's been a case of finding out yourself. Some of the things even now that I struggle with and I'm doing things the same way and somebody sitting next to me saying and I'm still picking up and I don't profess to be IT literate, all I'm saying is I get by slowly. Anyway I went on a course in Newcastle and there was no mouse, our class was basically using the soft buttons without a mouse. The bloke was saying to me it's a lot easier, don't need the mouse and it was for this guy and I actually passed. God knows how but I got a pass and would you believe I got a pass with distinction. I wouldn't even have a clue."*

The HSE Manager also went into his history to describe what ICT had become to him.

> *"That... computer, I think that's it. I think that's the key to that. I mean it's you're talking about information technology. Well that's all I can say about it. I mean it is.... I mean from my point of view quite honestly if I'd had this 35 year ago I would have been a different sort of safety manager throughout because in my early days, let's say they had an incident with guys doing sand blasting. I mean it (the sand) was permeating through the whole building..... on another job you'd probably have had a strike on your hands, other people wouldn't have worked there. Now I went on the internet just to get finer details, absolutely spot on, now if that had been 30 year ago I would have had to go to the library on a Saturday morning to go through trying to find something and where we are now with the internet is just everything I need is on there basically. You don't need to have a memory, you know what can I remember, what was this.... and I thought then and there crystaline silicate aye that's familiar, what was the maximum exposure.... straight there, know what I mean, that for me is absolutely marvellous. And for a company like this, I mean I sat at home and I was dealing with a manager on site, I was dealing with another manager here, I was dealing with the director of the sand blasting company and it was all done on there at home. That's what I think it is and you can do all that from the confines of your own home.*

He also mentioned that "I actually got my first laptop in 1996, aye, and I still cannot type a bloody letter! But again I've had no formal training." Again, training and experiences of ICT in the past have influenced the approach to ICT.

Finally, the office manager's experiences were possibly tainted with the recent upheaval of the implementation of the system itself, but she does not how the system is being used.

> *World would collapse without it. An archiving system and a storage system and a saving system, e-mail and communication system. What else is it? Just a necessity. Well it's a computer. To do my daily tasks I need a computer, I need a server that's actually going to back up my information to, I need e-mails account which combine the server, I need things like spam account from them which..... we have an IT company that I rely on fairly heavily so when there's technical problems that are beyond my control, that I can turn to that are going to be there to either do it over the phone to help me through it or come straight out. The size that the company is now I*

couldn't be without that. Mobile phones, telephone systems, broadband, 2D cards, 3D cards, memory sticks are invaluable. Back up discs. We also have a company intranet site that we do and that was purely used for downloading forms. Never for putting them up. Downloading forms and company internal news that was perhaps going to go out on to a website. But downloading forms, we never use to upload anything to it. It was served... at the time we had the equivalent of our like drivers and I had a P drive or whatever it was with the management one, so again it was project and company as far as I was concerned.

The next section of the questionnaire dealt with the person versus system conundrum, as used when discussing the MIS. Again, due to the nature and structure of the questions, not all the areas could be answered in the form as designed as he wanted to allow the respondents their own space to answer the questions from which the appropriate replies could be extrapolated. Also, the respondents are left in the same order as previously.

System	Role – ICT's in general			Project Manager - Information.... that's just what construction is it's just passing information and carrying that out. Nowadays you could have a client living on the other side of the country and if you're after instructions to carry something out , the communicating would just be impossible. Procurement Manager - Obviously you used to probably send a letter our and now you send a fax, so instead of taking two days and getting a response two days later you get a response the same day, so it's a lot quicker and easier really.
	Importance – ICT's in general, then specifically	Finance Lead - I mean you've got the age of the industry - we are the age of communication, you can't do anything now without it. I don't think you can anyway. I mean to be honest if the satellites all fell from the sky		Project Manager - No. I think it would be impossible to do without.

		you know a big sun burst or something, we would still live, I mean we could live without it but I mean obviously business just wouldn't.... you'd just be left behind, you wouldn't be able to do anything. Imagine just without excel, for me I wouldn't know what to do, I really wouldn't. I honestly would not know how to go back to ledgers.... I would not be able to use a ledger to keep the accounts going like the old accountants used to do. I don't know how people used to do anything.		
	Context – ICT in SMEcon – your work	Project Manager I think there is too much emphasis on information provision rather than what the actual information is telling you. Everyone is trying to get a new way of saying something or what information can we get, instead of saying we want to target and we'll look at that one and leave it at that but everybody is providing so much information because there is so many ways of doing things, so many bases, so many methods, so many distributions. You've got to find the right balance you know. What do you want? What you're looking at and get the information from that and only that and leave it at that. Don't go to the nth degree where you can have everything you can		Project Manager - Yes as the days are going on technologies are changing, things are becoming more difficult to build, things are becoming tighter, our clients are after shorter project periods. I guess project factors are changing, different stakeholders are more involved now. So many different elements, you definitely need it.

		possibly imagine thinking that's going to help you in some way. In this company a prime example, NR, he likes everything....., any bit of information you can possibly find remotely related he'll get it and you've got MT on the other hand who'll go right I just need a paper summary and right it's done in an hour. NR will take 6 weeks doing the exact same thing because he might feel that he's making a decision that's not complete, so which is better and it's just management styles, it is just how do you use information.		
	Purpose – ICT in SMEcon – your work			
		Assumptions	Expectations	Knowledge
		People		

Figure 6.4.3b – ICT replies 2

The Architect did not have anything to say about ICT that fitted these grids.

System	Role – ICT's in general			
	Importance – ICT's in general, then specifically			
	Context – ICT in SMEcon – your work			Site Manager 2 - I think it's made everything faster, easier, more so like allocation sheets just the one, sickness forms, everything.... it's there. On the other hand you're not carrying a file with all the relevant forms from your DLs, you know we've got forms, you know if

				you had a file of them and you didn't have a copying facility you'll need a dozen of each minimum. So I think it's simplified our jobs in that respect.
	Purpose – ICT in Smecon – your work			
		Assumptions	Expectations	Knowledge
		People		

Figure 6.4.3c – ICT replies 3

IP's replies did not have the necessary detail to fill in the grid.

The final grid consists of those who partly used the system.

System	Role – ICT's in general			
	Importance – ICT's in general, then specifically	Construction Manager - I know we did without ICT for an awful long time but not these days you couldn't Office Manager – I couldn't work without ICT.	Construction Manager - Firstly we're in a competitive market. Building. The most competitive market there can ever be and if, for example, they're transferring information around in between the clients and ourselves. The first thing is asked by clients, do you have a computer on site. They need to pass information to site extremely quickly, sites change, information changes, might be errors by the client as well as the builder, getting it over, they need to get over it quickly, if you don't get over it quickly it's cost. You can't ring up somebody and say I'd like you to come down and have a look at this, we don't have the time.	HSE Manager – I can't do without it, well, I could but it would be very, very difficult.

	Context – ICT in SMEcon – your work			HSE Manager - The information.... I have hard copies.... I mean before in actual fact I had Krona, they put these health and safety information right across the board, they've been going for years. The safety crew we subscribed to Krona and it was updated every month and that was the only source of information.... well not the only source, but one of the major sources of information coming through whereas now it's just a click of the button and it's there. I mean the HSA website I don't know how much it must cost them but it's a marvellous site, you know it gives new information every sort of week..... I would hate to think they'd suddenly decide we'll not bother because that would be.... and for the company everything I use is on there. If I want a form, if I want to do something it's all there, it's absolutely marvellous. Construction Manager - mainly it's been passing information back to the office quickly, I mean all of the timesheets.... some of the lads do that, they don't mess about with the sheets. The delivery trips, you know they keep them on record. Yeah when we had the last meeting I think there were only 12 delivery

				tickets outstanding in the month. But some of the lads are now making their own brief records, say for example they might have a delivery and there might be 12 items on it, they just make a note of what it is and the delivery ticket number so they know when it arrived and that's for their own records.
	Purpose – ICT in SMEcon – your work			
		Assumptions	Expectations	Knowledge
		People		

Figure 6.4.3d – ICT replies 4

Overall, there is an assumption that it is not possible to work in today's construction industry without the aid of ICT. However, the reliance on the systems appears to be marred with a level of distrust, with various groups keeping 'hard copies' of records, thus duplicating documents or their parts. This may be a specific issue with the adopted system itself or the training in its use. However, it could be due to 'tradition', where people are so used to 'how they do things', that any new system will have difficulty in totally removing incumbent behaviours.

The final question asked of the SMEcon staff involved hindrance. This user-based question was asked in order to give a general feel of the usefulness of the system without requiring specifics. The question was in three part:

a. Hindrance – due to 'time consumptions, onerous-ness, difficulty'

b. Harmless – No significant effect workflow or accuracy

c. Essential – In order to complete the task

Technically, only one answer per user should be forthcoming. However, as with many semi-structured interviews, this was not to be the case.

	MIS			ICT		
Who	Hindrance	Harmless	Essential	Hindrance	Harmless	Essential
Project Manager			✓			✓
Procurement Manager	✓			✓		
Architect	✓					✓
Finance Lead	✓		✓			✓
Site Manager 2			✓			✓
Estimating Manager			✓			✓
Construction Manager			✓	✓	✓	✓
HSE Manager			✓			✓
Office Manager			✓			✓

Figure 6.4.3e – ICT/MIS replies

Most respondents agree that both MIS and ICT are essential in their work. However, the reasoning behind the other replies are interesting, and giver a further insight to how both these terms are seen by the users.

The Procurement Manager felt that they were a hindrance. “To save it, uploading and then finding that document within a cascade, unless you have in your mind how you typed it, it could be anywhere on the list. I just find the Z drive so much more user friendly. I mean would you class the Z drive as a management system?” It was clear to the researcher that ISt saw the MIS and ICT as one entity and that the new system, the Kist, was not as effective as the previously used, z-drive, where files were stored by project.

The Architect did not see both ICT and the MIS as one. Indeed, he had only on issue with ICT.

> *“The only potential problem I can say I’ve had a slight problem in my laptop was stolen and I haven’t got a replacement and it’s slowed me down a little bit. I’ve had to load up on somebody else’s computer and somebody was on holiday and I used theirs and they came back and I had to go on somebody else’s, so apart from major technical hiccups like this stolen laptop or your computer goes wrong I don’t have any major problems with the technology.”*

As for the MIS, he was much more vocal on its merits.

> *"I keep my own folders and I would only have one folder for that project and everything would go into it and I would find it within seconds, if I'm having to look for a piece of paper whether it be a letter or a little sketch that I'd done or a fax that had come in or a piece of technical literature on a product that was used. If it was a bigger job then I might create a few folders and I would put all of the information ready to the electrical contractor in there or electrical design, one for the mechanical, one for the client, one for maybe drawing issues to the side and very very simple and I can't understand why there's a need for something different. I think any management or filing system should have a common sense approach to it. I do it and it's based on a system that I would have on the z drive, file and drawings, different types of drawings, correspondence, anything else but structured to my part of the industry and my part of the company. If I ever have to go and look for something say 2 years down the line or something crops up and I have to find the letter or an e-mail that was relevant to the issue it's much easier to find it by looking at the title of the folder or the file rather than having to open up all of them and read them individually."*

The system adopted either had not been designed to consider all the professional silos that make up the construction industry, and thus the company, or the users' own 'common sense' was not common.

The Finance Lead's response was interesting when discussing the MIS. On one hand, he claimed the system was a hindrance as

> *"... I can use up to 11 maybe 12 spreadsheets at any one time, I could use 23 in a day, to do any one thing and for me to then have to sit and upload them all or download them all, then upload them all once I've finished then that's all I'd be doing all day long and it just wouldn't be feasible for me. I mean I can change a spreadsheet 15 times in an hour, for me to have to upload and download that would be 30 transactions in an hour would just be..... it's going to be an hour anyway. I do believe in the system and I do want to use it to a degree but I couldn't use it in that format or the idea behind it of using every item has to be done."*

This was a specific issue with the storing and retrieval system, as well as the rule that everything must be on the system. However, the Finance Lead was also able to generalise about his feeling on how essential an MIS was.

> *"It's essential because there's too many people in the previous system that were just working on their laptops and no-one could see anything and then when they were off sick and they couldn't find it or where is it or if you come back in three years they've left two years ago and it's in their folder and when they're away it could take someone weeks/months trying to find this little bit of information but if it's in the same central format and everyone was using it then it would take less time, maybe wouldn't be instantly findable but it wouldn't take days/weeks, it's in their somewhere and at least you've narrowed it down to the right ball park. It is essential for this type of thing."*

The final multiple answer employee was the Construction Manager. He felt that ICT was a hindrance if you could not work it, harmless if you could 'do enough' and even essential, if you knew about it in-depth.

> *"For example would you believe it, it took me ages. I could never ever understand how somebody knew how to click the right button to get this information coming up and I used to think well what makes you... because nobody had shown me.... what makes you, how did you know that was there? Because somebody had told them. Nobody had sat with me at all."*

His issues were really about his own personal involvement with ICT, specifically MS Windows and its related products.

> *"If someone knew how to work MS Office completely, they could make a fortune showing us."*

6.5 Summary of Interview Findings

The researcher wanted to investigate whether people from out with the IS field, understood that there may be a difference between MIS and the ICT. Based upon the responses, which were not coached, it appears that most do differentiate. However, they do not necessarily match the definitions as given earlier in the thesis.

- Does the 'technological artefact' have different meanings and interpretations for various stakeholders?

It appears that both the technological artefacts did have different meaning to various stakeholders. This is mainly due to the SMEcon staff not really thinking about what tools they were using in the same way as each other. Some saw ICT as a more communications based idea, whereas others thought IS was computers and software. The one highlight for the researcher was the Construction Manager, when he answered the 'what is ICT' question with computer skills. He was the only person to make the leap, maybe unintentionally, between the artefact and its usability through ability of the user.

- Had the description of the artefact been stabilised? Closure in technology involves the stabilisation of an artefact and the removal of any problems.

Rhetorical Closure is that the closure of a technological "controversy," need not actually solve the problem. It only requires the relevant social groups to see that the problem has been solved but closure by Redefinition of the Problem is much more complicated, in that it solves one problem, by inventing another, which is then solved.

The researcher believes that rhetorical closure did not happen across all the staff. Due to the nature of SMEs, there rarely is the opportunity to form groups in the manner of larger organisations. There are no departments, such as Human Resources, Procurement or IT, therefore these groups cannot gather, making social grouping in their specialist silos impossible. However, as a company, they can group socially, making the fact that rhetorical

closure did not happen all the more concerning for the company-wide adoption of the artefacts.

The problem was not redefined either; it was just made obvious. By attempting to adopt the system, SMEcon managed to illustrate the main issue of company processes. The only company processes that existed had grown organically, through the growth of the firm. There were no written procedures within the company, nor any formal audit trail of functions. Everyone had a title, but due to the SME culture, did not have prescribed routes of action. They only knew what others were doing by discussing issues as and when they occurred. This became more difficult as the firm grew, as this loose communication system could not cope with the demands of so many people doing many different tasks.

SMEcon's directors had employed people into positions, which they were qualified for, and let them 'get on with it'. They did not give explicit guidance on how the company would process its business. This issue alone will cause SMEcon many issues as it continues to grow, and, indeed, may even prevent it from growing. It will not be able to implement a proper MIS until the staff understand and engage in more formal processes.

The third stage attempts to relate such "closure mechanisms" to the wider social-cultural milieu. The researcher, based upon the conversations during the interviews, attempted to glean a contextual, social discussion where the interviewees were asked to relate their experiences with the artefacts' adoption to their own overall experiences, whether in previous work or home life. This socialisation, once identified, should alter the subject's ideas of the artefacts.

This process was very difficult, and may have happened partially with some of the respondents. As each interview developed, the researcher became aware that some of the interviewees were beginning to think about the artefacts slightly differently from when it started. This awareness was especially prevalent in the interviews with the Construction Manager and the HSE Manager, the oldest staff members. They both were able to discuss the system in relation to others used, and to their own experiences of leaning about them. Both the Construction Manager and the HSE Manager seemed to have a settled idea of what the system was and how it fitted into the environment within which it worked. They were also able to discuss why it wasn't working and the basic issues preventing its full use.

Overall, technological frames and the use of SCOT were very enlightening, and gave great structure to a difficult project. It stabilised the project whilst allowing the actors to have room to make their observations freely whilst keeping the whole process contextually relevant. The

researcher feels that context is vital when investigating standalone projects, as there are many outside factor that will affect them.

6.6 The Corporate Strategy.

Two of SMEcon's directors agreed to be interviewed. The third had not been involved in the adoption programme, so it was felt that his input would not be as relevant or necessary.

The first two questions were very straightforward:

- "Why did SMEcon need an MIS/Document Repository?"
- "What is the overall purpose of the system?"

Managing Director	You need a system to work to. You need to have processes and systems to work to for the simple reason that its document retrieval and information retrieval and everyone should be doing things in a similar way. If you look at big organisations like MacDonald's and Tesco's and places like that they'll all have tried and tested systems and more efficient the business is the more profitable it will be. So it's important to have a system in place. Working in the same..... you know there's a process to go through and as long as everybody understands... I mean a lot of people don't understand that there is a system, they don't you know it's difficult with people to get them to accept that the system is there to help them make things easier for them, it's really a guide if you like to how to do things. That's what is needed in a business, which was the reason for getting yourself involved. The big issue was that it was supposed to have the system up and running before we kicked the business off, okay, which we failed at. We have a system of sorts now but still isn't actually up and running smoothly at the minute. We need everyone to understand what effect their task has on everybody else. It's... you know you talk about flowcharts and processing systems, it's just mapping out that system. It's a flowchart really on from an item coming in to the business and what happens with it and each person should understand what happens to that and what their role and responsibility is.
Commercial Director	Well there were probably two or three main drivers for it. One was to have a standard system that everyone would use so that the filing and retrieving, and particularly the retrieving, information was simplified because prior to introducing this we had a number of individuals coming from perhaps different companies used to doing things differently and we just found people were filing and storing information in different fashion. We did have right from the start a basic filing system but we found some people just ignored it and created their own because as I say they came from different organisations to join us and there were probably as many filing systems as there were people in the company. So the standardisation of that, so we could retrieve information. There was a couple of other sort of drivers from which pushed us down the IT route. One was people created a filing system fairly early on which was available electronically just on shared drive on the server with a series of folders but people complained from site that they couldn't get access to that via the web, which was the route, so one reason was initially about access. There were side issues about issue control. We were obviously updating standard documents and people were continuing to use old versions of it so again the IT became the solution to that. But the basic drivers were make sure that we retained all the information that was out there on site and that we did it in a standard place if you like, a standard system so that we can retrieve it more central and that way it became

	more consistent the information that we actually kept so that we were able to dictate to people what information we wanted them to provide us. A flow of information from project level and to sort of director level so we have the information to be able to manage the company. So it was probably a combination of those things. Standardisation of where it was kept in the format that was kept so it becomes a system, it was a quality control thing, a flow of information issues for that information used within the company.

Figure 6.6a - Directors' replies 1

They both talk about standardisation and process across the company, and allowing others to understand what they do affects others and how. However, the Commercial Director is more interested about control. He perceives the system as a mechanism to reign in processes that are not necessary to the operation of the company, as he sees it.

The third question directly asks "Does the kist manage to meet the purpose?" with supplementary information to justify the responses. This was asked as the researcher wanted to know if the expectations matched the actualities of the project. The researcher has also included further questioning and clarification made during the interviews, in order to give proper contextual weight to the responses.

Managing Director	No, it does not I do use the Kist, it's up there, we have all the projects on it but there are gremlins in it for actually saving material, there are still issues there for people to use it. The lads who will use it..... There are certain people in the organisation who are computer literate if you like and there's some that aren't so much but the lads who aren't computer literate just find it difficult to use. Time consuming, Number of clicks how to save information. I hear examples out there. The other day somebody wanted to upload a load of photographs to the system and they couldn't just highlight all the photographs and say save so there's little things like that and if you as you know if you're working on a word document you have to sort of download it, save it, and I understand the reason for that so you can't overwrite on something and it's a history of information there but it does seem to be cumbersome and long winded to use for some people. The other thing is I'm a great believer in Kist, keep it short and sweet, and I think we've ended up with something that's too... too complicated I think for what our business needs. So if we're starting again we'll probably do things differently.
Researcher	What do you think that was missed?
Managing Director	I don't think it's got missed I just think there's too much. A simple thing is the filing index is unbelievably long, I cannot stress how.... you know I've worked at various businesses, I've worked at big PLCs who've had very complicated filing systems but this just takes the biscuit what we've got here and it should be very simple and people don't understand..... you know unless you're qualified technically to understand things people don't know where to file stuff and that's the problem and it all starts from that which is the basics really. The file system's too complicated. Well we've got it now, all of the projects are uploaded on to it but people find it difficult to use but all of the projects are actually on there, everything is uploaded but people find it difficult to use.

Researcher	Is it difficult technically to upload and download stuff?
Managing Director	Yes it is.
Researcher	But independent of that you are obviously saying that the actual filing index, which is the structure of it, is overly complicated too. So there are two things. There's the structural issue of what the index actually is on that information system and then there's the ICT end which is the clicking and saving it.
Managing Director	Yes.
Commercial Director	In practice, no. In theory I don't know. In theory yes but in practice no.
Researcher	Okay, define each of them then.
Commercial Director	The KIST is a good system for drawing down standard documents and I think most people sort of acknowledge that. It's been found by pretty much everyone to be a difficult system to use, to actually file and store documents just with one or two technical issues, so we're finding that people are still finding ways to operate outside the system so information is still being stored where we can't necessarily find it, for example on people's own desktop machines. So in terms of comprising a management system then no it's not actually working. If those technical issues were resolved so that became more user friendly then yes I think it could do that, it would provide a consistent framework and everybody would be able to store their information and we would then be able to handle the QA (Quality Assurance) side of things of checking the information that people are keeping in the format and the accuracy of it much more easily than we can at the moment. We're sort of stuck at base one because the information still hasn't been stored in that system.
Researcher	You need to monitor the system? If some people were using it do you think it would be an easy process to do that? Was the system designed for that?
Commercial Director	Not really no, not yet. We're building blocks I guess so the first thing is the get the information into the system and yes it would be manual checks initially just by sort of spot checking. I think potentially then you could build in more automated checks but like I say we're still just at stage one, just getting people to actually store the information in there in the first place. So there's certain development really. It's not feasible to go on to the next stages until we get stage one fixed, which means ironing out some technical problems.
Researcher	Does the Kist represent the vision that you had of what it would be able to do minus the technical difficulties obviously at the very beginning, well at the beginning when I was involved which was two and a bit years ago now? Is that what you saw?

Commercial Director	In some respects yes, I think the visual side of it that it looks user friendly initially when you've got nice big buttons and nice clear navigation. I think the first steps when you use the system are absolutely straightforward so that sort of works. The more you come into it and more in depth we've gone in the use of it and broadening out and deepening if you like. Across a number of different users and right across the company and it's just got more and more complex. So that very simple 'fisher price' as we call it usability has been lost really and I think if we ironed out all these technical problems and then come back around the loop to maybe look and feel straightforward and reintroduced. At the minute the more work we do the more complicated it will become. Just part of the process. The Kist gets more complicated and eventually you move it all back to the z drive again. We're only half way down that journey.

Figure 6.6b - Directors' replies 2

These responses were really split into two areas;

- The ICT abilities/usage
- The system structure.

During the system development, a 'saving issue' had arisen, where to use a document, meant it had to be saved on the users' computer, used (filled in), then saved again before uploading onto the system. This was a direct issue with the software bought and there was no technical solution to this. The Commercial Director was upset at this, as he felt it undermined the control over the users as to what they could do with the documents. The Researcher felt that this could be circumvented by education and training. If the saving process was made into part of their process, then it should not be an issue. The photo uploads was unfortunate, as the system was not designed for bulk uploads, and that specific project was very unusual compared to every other type of contract that SMEcon had won.

The second issue was around the complexity of the filing system. Both new the need for as simple a system as possible, but also acknowledged that the one now adopted, was not simple. This was independent of the ICT-based system.

The researcher then questioned the directors on their understanding of stakeholders, their needs, and the prioritisation of stakeholders needs. Again, the researcher has included further questioning and clarification made during the interviews, in order to give a contextual flow to the responses.

Managing Director	Yes, two particular individuals – Who, at the time who were crying out for a system. They had information as well on the laptops which was from their laptops and not in the company's hands and as we know what happened to them what two years ago now, over two years ago, they left and set up themselves.
Researcher	Those guys were commercial guys?
	They were a project manager and a commercial guy.

Managing Director	They weren't on the payroll?
Researcher	They were, they worked on the hospice which was a big job for us. It really was to get people performing the same tasks in a particular way and as I say people were crying out for a system which we said we'd have up and going within three month..... we didn't say two or three years in front of it but.....
Managing Director	Okay. So the stakeholders were the guys that were going to be based on-site or managing the site running projects really?
Researcher	Running projects and there was a great need for them to know what the company required them to do.
Managing Director	It was a two way process.
Researcher	Really it should just be a company manual on how the company carries out the projects, that's basically what we were trying to achieve.
Managing Director	Now that we're at the stage because the company has grown a fair lump to be honest since we started the project to where we are now. Do you think that system that was asked for originally is relevant?
Researcher	Yes, I would say yes we should have a system.
Managing Director	Well there are guys on site who are computer literate and they are using the system, they have been using it. There is the only guy I think who hasn't got a lap top at the minute, he has problems switching the thing on I think but he's just not comfortable with it but the other lads are fine, and we've got another guy, an elderly guy who uses the system well, he's quite happy to use it. I think it's excellent for retrieval of standard forms.... at the minute what it's good for is getting standard forms, it's excellent for standard forms, but after that it seems difficult for people to get information on to the forms for that to be saved, they find it hard.
Commercial Director	Yeah I think the biggest problems that we had were the guys on the site and very simple activities and just recording of basic information so I think that was where our biggest problems were because the office wasn't getting information from site, very basic records, and so that was probably our last starting point and we thought that by dealing with their issues that the stuff in the office actually would be a lot simpler because people in the office were a little bit more sophisticated in their use of the IT, we tended to use systems and be more systems orientated I guess, a little bit more fluent in that language if you like. So it appeared that the structure and the issues that the interface users in the office were actually pretty straightforward, you were dealing almost exclusively and starting off with site issues because that's where the problems for the company were coming from and people in the office were using standard systems, albeit paper based or whatever, people on site just weren't. So we started off dealing with them and what could happen during that period the company grew and we brought on some new business streams and we've effectively developed a broker, a sort of range of users, some of whom designers for example just work in a different way to some of the people that it was originally designed for. So it's generated more and more issues as we've gone along. The company has got more complex. The information flow's got a little bit more complex but there's certainly a lot more of it and

	the format of it and the way that information is used has developed. So the timing of producing the system and growing the company is some respects was a little bit unfortunate because we started to produce a system at a time when the company was relatively simple and straightforward in its information, the company has changed. The structure and the people in it have changed and the system has struggled to keep up with that really.
Researcher	So well that leads back on to my next question as well which is because the system designed fits the current way the company has to operate.
Commercial Director	No. It almost does because as I say we've worked hard to try and catch up with what was happening and then to foresee a little bit and try and get a little bit ahead but it was not originally designed for what the company is now. So that's always a catch-up exercise and there's always compromises we would have a different view of the company now to what we had then because it is a different company, it is a different structure now to what we had then, so that would also allow us to avoid the error in developing a system that wasn't designed for our company and ended up being.... so that crystal ball side of things was something we didn't get right.
Researcher	Not many folk get the crystal ball right, that's the key.
Commercial Director	I think that's partly true. I think one of my disappointments, beating myself up because I didn't foresee this, but that some of the advice we got on day one was basically not to try and foresee those things but just deal with very real issues and examples as they are now, and to grow a system out of dealing with those initial problems rather than try to take perhaps a more strategic role long term view of the system. We were encouraged very much to... and this was actually a phrase used to design it from the bottom up and again hindsight is a wonderful thing but I think that was a mistake and if I beat myself up that was my mistake if I was watching day time television and wanted somebody to sue I would say that was bad advice I was given.
Researcher	Okay, well they were the stakeholders because you say the stakeholders were the people on site.
Commercial Director	Everyone really and you've got to create a management structure of the company and the reporting structure which as I say then we were such a flap, the structure in the company that it didn't really exist, it was just those in the office and on site whereas now we've got layers of management where we've got projects and we've got a management structure cutting across projects, the company if you like and the issues that the company has to deal with. It was all very mixed together at the beginning and a very flat structure. So I think you could map those information flows and those roles and responsibilities much more clearly now. I think if somebody asked me to I could have done that two or three years ago looking five years down the line because there's some theoretical stuff there that just sort of applies across the board. We've got the experience, we've been in bigger companies, we've managed bigger companies, we could see where that structure was going to go, put a timescale on it and you know the finer detail of it yes that crystal ball. If somebody had asked us what we thought the structure of the company might look like in three or five years and what the information flows would look like we wouldn't have been working from imagination, we could have done that from experience because we've been there before and that's where I am a bit disappointed with hindsight in that I didn't think that clearly enough

	and wasn't encouraged to think that way. In fact we said do not think that way, let's just design bottom up and so that was a mistake.

Figure 6.6c - Directors' replies 3

These were remarkable responses. The Managing Director clearly felt that the system's main stakeholders were represented by two people who subsequently left the organisation, taking the information they had, and starting a company themselves. These ex-staff were mainly based in the office and ran the projects from there, with regular visit out to site. This was in stark contrast to the Commercial Director's original system design of 'from the bottom up', where the site-based employees were the most important. It is also interesting that Commercial Director felt 'badly advised' in this path, with the researcher wondering who advised him. He also mentions the issues with the company's growth, and its structure being added to by a management level. However, the researcher did advise the Commercial Director on this level as a necessity before SMEnet was brought into the project.

The final strategic questions asked the directors the following.

- Does the system fit with your current operations?
- Is your corporate structure suitable for your planned operations?
- Will the system cope with this?
- What is the future plan regarding the system?

The researcher has included all the questioning and clarification made during the interviews, in order to give a contextual flow to the responses.

Managing Director	Yes, to be it needs.... we constantly need to be looking at it, see that it is relevant to the business and we should be updating it. That seems to have been an issue with people, people have brought comments along and they haven't been taken on board, they haven't been actioned and that seems to be a problem.
Researcher	What's the future of the system?
Managing Director	I download forms off it. The odd time I have gone to use it, the times I do go to use it I find the information very difficult to get off it. The latest example is we've had somebody who started here fairly recently, came in and I thought right we're doing an induction for this particular girl so I went onto the Kist, went on to try and look for it myself, I couldn't find it and eventually threw the chair at the computer and started shouting, I went in to see NR, I said "do you have....." and NR is NR... "I'll find it you're an idiot, I'll find it because you can't use computers sort of....." so he went on it oh it's not there, ah right, I asked AD to do that and AD hasn't...." you know it's always somebody else's fault sort of thing. Well that's right that's what happens. I think it's feedback as well and I think you have to have a system full stop

	but people I think have ended up feeling like it was yours and NR's project or whatever as opposed to this is for the company if you like.... NR's project, that's how people have felt I think.
Commercial Director	No I think at the minute the structure, in my mind, and possibly in terms of things like indexes and the Kist etc. is probably ahead of where the company is actually now and that's partly a deliberate thing we've realised partly through this project but other things obviously happen in the company as well and that's something we needed to do. We started off as I say with a very much flat structure, three directors involved with all the projects working day to day, realised that if we're going to grow the company and my personal objectives for the company that that wouldn't work. We had to start thinking a bit more strategically and look further ahead in terms of time and that's something that I've deliberately done myself, I've pulled myself away from the day to day sort of side of things, so I've taken a little bit more strategic so the systems as they are now and as close as we can we've created them or developed them and the company's needs in terms of personnel. I think just as an example if you take that middle level, that middle tier of management and got 7 disciplines in there. If you said who would make up the 7 disciplines probably you could only name half to two thirds and the others are sort of missing. You've got areas where one person is perhaps covering two or three different disciplines or even working at different levels, at project level, at management and perhaps even from director level down, so we've got those sort of overlaps so the structure is there and will allow to company to grow.... but yes the company needs to grow into that structure. This is again an issue with stakeholders. They don't perhaps understand that there are elements in that structure that they wouldn't see as necessary because nobody is there, or it's just part of another role that someone has, they don't see that as being a separate role or a set of separate responsibilities or separate disciplines. They can perhaps see where they're coming from but they can't see where they're going.
Researcher	Final question on this section is what about future plans regarding the system? You said you've already built in structure. Where do you see the system having to move to or does it have to move?
Commercial Director	I think it has to change, it's not working at the moment, it's not being used. It's not being used and it's not working in terms of achieving what it's meant to achieve. I can see a number of options. Scrap it and start again – which actually is an option but for various reasons cost and time and everything else not a very attractive one. We can continue with the system as we have and try to develop it and improve it but it's pretty clear there are a couple of areas where the software that we have just have limitations, you know we're always going to be compromising so again it's not a particularly attractive option at the moment because we know we're always going to be working within restrictions that really are frustrating so we're never going to have a system that people feel comfortable with and happy using. But having come this far there is an argument to say push on and make it the best system you can and at least in the short term. There are options obviously, to look at alternative software and just take the lessons from what we've learnt here and perhaps some of the stuff that could transfer a new system like the documents for example in structure and just use different software so there are time and cost implications in that and we'd need to make sure that we don't make the same mistake again perhaps picking the wrong software or the wrong developers. So that's another option. We're sort of exploring those at the minute. I've got a couple of alternative companies we're looking at and either off the shelf software, that could be tweaked to suit our needs or whether you're looking at an alternative software like SharePoint which again when we started out, couldn't find anybody to give us advice to tell us whether it was the right thing or not, it turns out it probably was which is frustrating. I think at the time I always felt that that was the right option but I couldn't get anybody to go with it, so we ended up going with something I was never 100% comfortable with but appeared to be the best option available to us.

	So it's frustrating that one, my gut feeling was probably right and what my first instinct was to go to SharePoint even though I didn't really know what it was, was probably actually the right one. But that is another option. better lessons out of this and put it on to something like SharePoint as an alternative system. So I'm told there's a lot of work being done on SharePoint on the two or three years we've been working on this so there are organisations out there who have developed SharePoint fairly quickly and quite effectively. I'm also told that there are now one or two sort of off the shelf certainly in terms of document management systems, information management systems that could be tailored to suit the way we work. So I'm probably just going to ask for some proposals, outline proposals, from people who know what technology is out there, what might be the sort of time and cost commitments that would be needed to develop an alternative and I guess what we'd really like is a front end which is similarly user friendly and fisher price to the one we've got and a back end that just works from a technical point of view. And we're looking at things like for example going back to the back end actually being just based on shared useful owners sat on the server, which is what we started out with. SharePoint is a slightly more sophisticated way of doing that. There are very different issues with that in terms of security and access and the like... that can be got round. So at the moment yes exploring those sorts of avenues just in theoretical terms but in the meantime we really need to I think improve the system we've got and try and get as much benefit out of that as we can until such time as we're confident we've identified the right solution for SMEcon. And also the time and people and financial resources are there to actually make it happen and if we do have a version 2 it would have to happen much more quickly than this one, we couldn't afford to go through the sort of growing pains that we have with this one and the frustrations that go with it. So at the moment yes we can't in a way go backwards, well we could, we could just abandon the whole lot and go back to paper files everywhere. But we've done some good work in terms of developing the documents and those sorts of things so we have got some standardisation there which is helpful and we need, so you know we're never going to go completely backwards it's just a matter of how we make that available and what kind of a mechanism do we use to structure it and save it and keep the security right.
Researcher	Do you see basically whatever new system comes in just basically replacing what Kist is and therefore removing the technical issues so therefore it's still going to be a document repository system, so you're still going to have information sitting on what is basically a sheet of paper in the system, sitting on your shared drive or SharePoint or whatever it is?
Commercial Director	I'm guessing that we'll probably have to go through that stage before we get to more database, interactive, pieces of information. I'm guessing that we're still going to have to go through that intermediate stage of making the paper-based system work. Now whether that's just a lack of confidence and understanding from my point of view I don't know but I wouldn't feel confident personally and I don't think anybody in here haven't had the experience we've had over the last couple of years nobody here would feel confident in going to a completely different type of system until we get this one to work. Not necessarily this bit of software but this type of system whereby we can draw down paper-based forms fill them in, save them and have that flow of information working. I think to go completely electronic and as I say interactive database type information would just be a step too far, it would feel like a leap in the dark for us.

Figure 6.6d - Directors' replies 4

The Managing Director feels that a system is essential, but did not go into details. He also gave an insight to the conversations within SMEcon about how the project was perceived. The researcher always saw the danger of the system being 'someone else's' project due to

the manner in which he was inducted into the company. He always felt ‘at arm’s length’. However, the Managing Director’s feelings on how the Commercial Director saw him were also revealing, as were his reactions.

The Commercial Director admitted his mistakes. However, he bought the SMEnet solution, without any tendering process, or in-depth advice. He had also seen the report that were submitted before the research began, providing some ICT-base options, as well as the report from DW and DH, which clearly give options regarding SharePoint and some local firms involved with its distribution.

6.7 Relationships

The researcher has alluded to some of the relationship issues that occurred through the duration of the project. Some of these were expanded upon in the interviews, including an apparent split at the boardroom level.

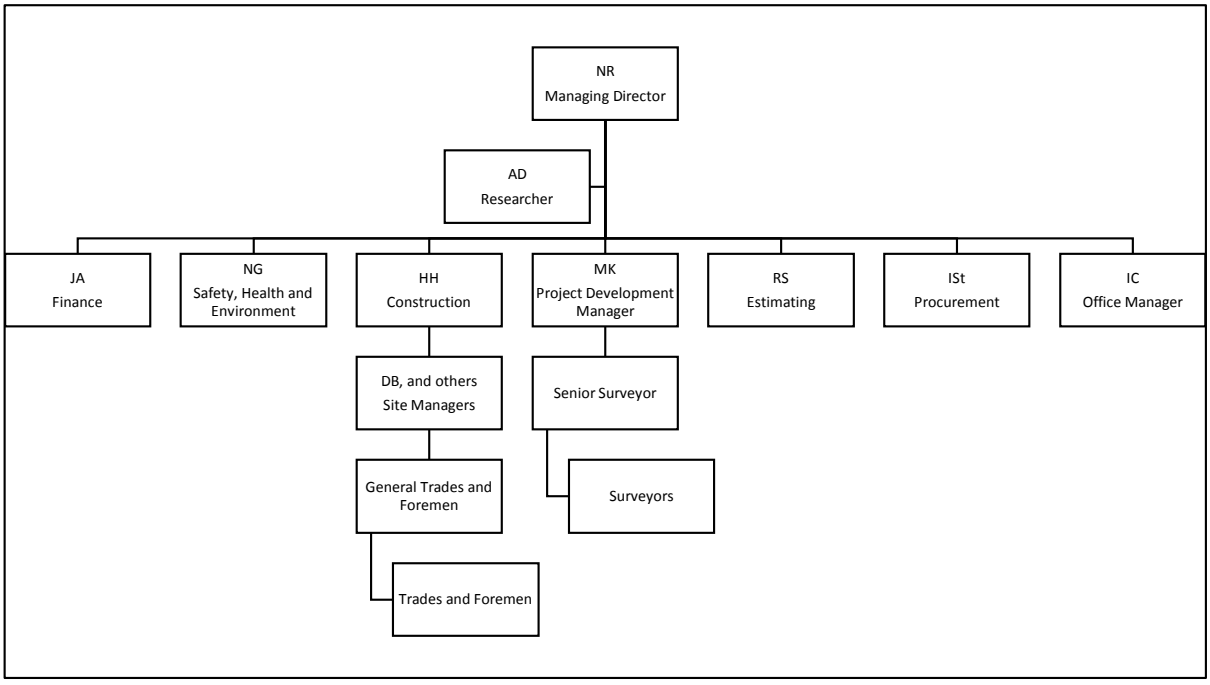

Figure 6.7a - Project Structure, adapted from UKAIS 2008 Presentation

The previous figure shows the information given to the researcher by the Commercial Director (NR) in early 2008. As can be seen, the Commercial Director was named as the Managing Director, which was not the case as the researcher found out somewhat later. There is also no line joining the researcher to the rest of the staff, as he wasn’t introduced to

them until later that year. At this time, the Office Manager, was not married to the Managing Director. This relationship was also unknown to the researcher until after the wedding.

By the second cycle of the AR methodology, two other firms were now in contact with both SMEcon and the researcher.

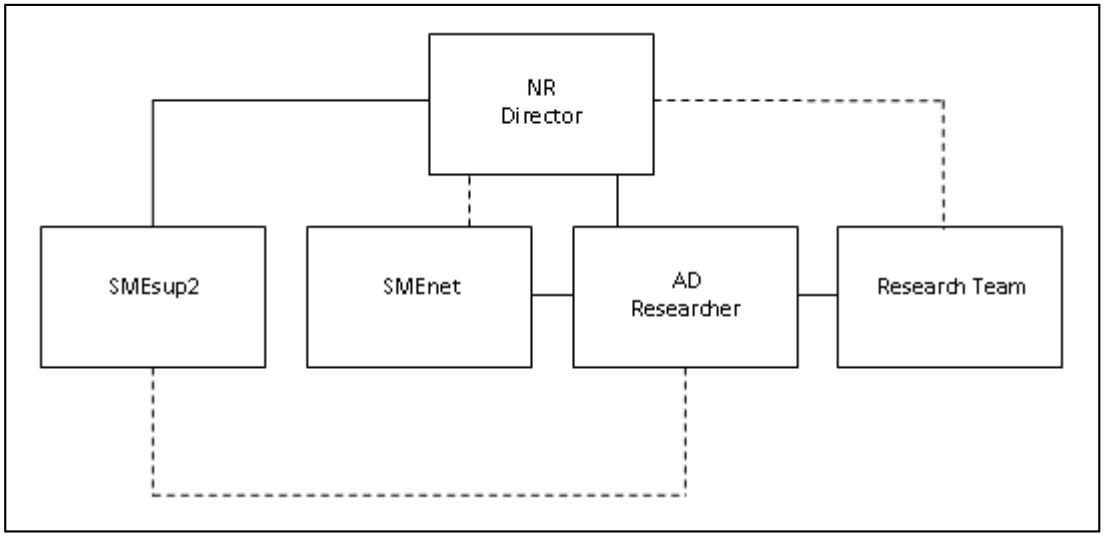

Figure 6.7b - AR Cycle 2 Relationships

As noted in this figure, the researcher had direct contact with the Commercial Director, SMEnet, who he was project leading regarding SMEcon, and the research team of DG and DW. However, the researcher has also shown the informal communication routes between the parties involved, including the Commercial Director and research team.

During this cycle, the researcher was made aware of the actual Managing Director of SMEcon, and the Office Manager's wedding. It was also at this time that SMEnet contact 1 left his organisation, leaving the researcher and SMEcon to establish a new working relationship with SMEnet contact 2, who happened to be married to SMEnet's owner.

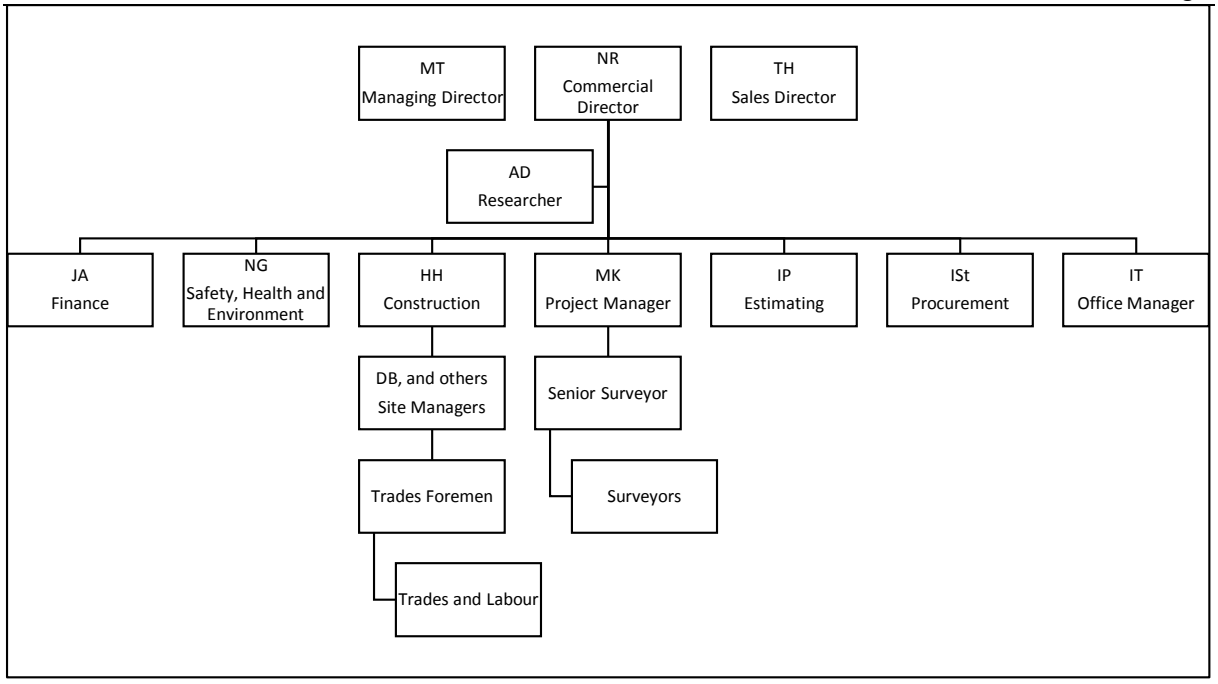

Figure 6.7c - Project Structure, adapted from 2010 UKAIS Presentation

The final figure shows how the project ended and reflects the different names and relationships within the firm. The relationships between various project members did affect the project in some subtle ways. The Managing Director and Office Manager's relationship made communications within SMEcon's office environment most interesting. No-one was willing to say anything too derogatory in case it was passed to the Managing Director. This reflects a typical SME issue, where personal relationships, however professional the people may be, affect the office dynamics. The relationship between SMEnet contact 2 and the owner failed after the researcher left SMEcon, causing SMEnet to fold as a company. Initially, another company took over the contract, using some of the staff it incorporated from SMEnet's demise, but the researcher understands that this has since ended.

The relationship between the Managing Director and the Commercial Director is puzzling to the researcher. They have a long-term working relationship from their previous employments. However, although the Managing Director was the MD of SMEcon, the Commercial Director was leading the adoption project, with, what appeared initially, as little or no direct input from the Managing Director. It wasn't until very late on in the process, that Managing Director became more involved. It appears that they had split their roles, with the Managing Director 'running the company' and the Commercial Director dealing with more strategic issues, such as the new system. After the interviews, the researcher was able to note friction between them. The Commercial Director has since left SMEcon.

The researcher was also aware of DG, and to a lesser extent, DW's relationship with the Commercial Director. Obviously, this had some roots in the previous research and projects done together, but the researcher still felt that this affected his behavior when discussing SMEcon related issues, either with the Commercial Director, or DG. The researcher feels that this occurrence can, if not managed properly, have a serious effect on the research itself. In this case, it was managed very maturely and did not affect the research outcomes.

6.8 Aims and Objectives revisited

6.8.1 The Original Aims and Objectives

The original aim of this research project and study was to model the creation of a Management Information System for Construction SMEs with a view to implementing ICT solutions. In order to accomplish this, a number of objectives were identified as integral to the project:

- A review of current SME business process models in both the construction and other industries.
- The formulation of a model that outlines business processes in Construction SMEs.
- To test the derived processes in the workplace.
- Creating significant financial benefits in terms of efficiency gains from enhanced ICT systems capability for SMEcon.
- New marketing opportunities for SMEcon.
- Development of competencies through organisational learning for SMEcon.

None of the original objectives were fully met, meaning this project has not modelled the creation of a Management Information System for Construction SMEs with a view to implementing ICT solutions. As can be read throughout the thesis, an MIS was not even adopted due to the decision by the Commercial Director. The research team did not review the current SME business process models, formulate a model outlining business processes in Construction SMEs, or test them.

This was mainly due to the researcher following the needs of SMEcon and, in particular, the Commercial Director. It was apparent from the beginning that the adoption of the document management system was urgent. The paper-based system was not operating efficiently and had not be customised fully to SMEcon's requirements and this needed to be addressed. Also, the Commercial Director's decision not to allow the researcher access to the staff member, blocked his ability to find out how the company worked as an observer, a key element in AR. It was the researcher's aim to see how SMEcon was working, with whom,

and when, in order to compare it to the knowledge base within that area of research. This was not possible.

The project did not, as far as the researcher knows, create significant financial benefits in terms of efficiency gains from enhanced ICT systems capability. Indeed, due to the procurement decision by the Commercial Director when employing SMEnet, it increased the cost of the overall project. If the Commercial Director had tendered to opportunity to other firms, with other solutions, the study would have encountered more of the questions that were not asked until cycle three, earlier. The research team would then have been able to deal with the issues before they became problems that needed expensive reworking.

The project did not develop the company's competencies through organisational learning for SMEcon. Indeed, with both the researcher and the Commercial Director leaving, there is possibly less knowledge than before. The isolationist policy of the Commercial Director throughout the project meant that any learning was not spread around the organisation. It did, however, have an indirect positive impact on creating new marketing opportunities for SMEcon. By redeveloping the website, it gave SMEcon confidence that the internet was not a difficult arena on which to create an image. Their previous website was static and required expensive specialists to make alterations, whereas the new site was easily adapted by SMEcon staff. However, the layout, as designed and approved by the Commercial Director was not what the Managing Director wanted and they have since re-launched the website with a different supplier, matching MT's vision more closely.

However, the SMEcon project developed a new pathway with many key decisions completely changing the direction when compared to initial thoughts. As highlighted in Chapter 3 - Methodology, this was meant to be an Action Research project, with both the researcher and the organization learning about various issues as the project progressed. Indeed, the project did follow the form of an Analytic Auto ethnography as it met the five key features as described by Anderson (2006). Also, and more importantly to SMEcon, they ended the process with the system they procured, working exactly to their specification. The project's alternative pathway has had a large effect on this thesis. The researcher has still been able to publish the anonymised details with the aim to gaining a research qualification, as well as presenting at various conferences in both the Construction and IS research fields. However, with the project deviating from its intended course, it has also contributed some other unplanned insights to the field of study.

6.8.2 Revised Aims and Objectives

As mentioned earlier, the research problem for the study was primarily based around one topic:

> *"The lack of business process information in the construction industry, making decisions on management system requirements, identification, design and adoption very difficult."*

This proved to be the case at the earliest opportunity both the project and study's timeline. The study began at the end of September 2006 however the researcher did not begin the project element until January 2007, thus beginning four months late, as the SMEcon did not have the resources available in order to collaborate due to other work commitments.

The project also lacked some major constituents that, based upon the previous documented work undertaken, should have existed and been applied:

1. No standard operational documented processes or work forms.
2. No independent technical/management/project advice.
3. No project consultation on the ICT solution to be used, although some limited advice given.

These elements were necessary to form an operational basis that the project could then build upon. Added to the above mentioned points was SMEcon's decision not to apply a tendering process when they went to market to purchase an ICT solution.

The full story of how these missing elements directly affected the working of the project are captured in detail through the researcher's diary entries, a sanitised and abridged version of which are captured in Chapter Five. Two key project outcomes were produced due to these missing elements and processes:

1. SMEcon did not adopt an MIS.
2. SMEcon did adopt a DMS.

This radically altered the aims and objective for both the project and the study. The project's objectives were now:

- To design and adopt a paper-based standard form library that is based upon desired working processes within SMEcon.
- To apply this model to a newly purchased DMS, including configuration of the DMS's workflow system.
- Adoption, user training and rollout of the DMS across SMEcon.

The overall aim was for SMEcon to have an operational DMS across all users that would create an efficient, standardised workflow model to manage their document processes. This

statement was never explicitly made during the project. The aim of the study has also changed completely.

The study will analyse what happened in the SMEcon project with a view to answering why it occurred and what this could mean to wider SME communities. The objectives to meet this aim are:

1. Review of the adoption of a new paper-based form library within a small company and its effects on the business.
2. A review of the overall DMS adoption project and the decisions that lead to it.
3. Extrapolate learnings from review evaluation interviews
4. A comparison of this project's process with other documented studies

All of the revised project objectives have been met.

- SMEcon adopted a new paper-based standard for library
- The model was applied to the newly adopted DMS
- All users with access were fully trained and supported in the DMS's use.

However, it was far from efficient or easy to use, which means it failed in its ultimate aim.

The Study has met all of its aims and objectives. Using a revised form of AR other than the planned participative model, the researcher has:

- Fully reviewed the library within an SME and how it affected the business.
- Reviewed the DMS adoption process
- Attempted to glean learnings from the project by interviewing the stakeholders
- Compared the project's processes with other studies.

The researcher also had to manage his academic work load, which included many taught seminars, as well as conference paper writing and presentations. He was also managing a unique relationship within his educational establishment. Although the primary researcher was based in the School of the Built Environment, he had a supervisor in the School of Computing, Engineering and Information Sciences. This involved two very different methodological approaches and knowledge bases. When combined with the commercial pressures of SMEcon, as well as the researcher's own bias and background, it formed a very complex mesh of ideas and opportunities. This gave the researcher some freedom in methodological approach, in spite of the study already being an Action Research project.

6.8.3 Bricolage

Utilising available resources to create new forms and order from tools and materials at hand has been defined by anthropologists as ‘bricolage’ (Strauss, 1966). The main feature of bricolage is that it builds up structured sets, not directly with other structured sets but by using the remains and debris of events: in French 'des bribes et des morceaux', or ‘odds and ends’ in English. This fitted very well with the researcher’s approach, as he had a legacy of other projects completed within the firm and the afore-mentioned commercial pressure, both of which provided a direction for the study. This meant that the overall scope for implementing change into the organisation was limited to the document management system and its adoption only, rather than the planned aim of adopting an MIS.

By strict definition, the bricoleur’s ‘universe of instruments’ is limited, and he will make use of whatever is to hand (Ferneley & Bell, 2006). In the case of this study, the researcher used the company’s existing technologies and the redesign of the new system to attempt to enhance the organisation’s communications.

“The ‘bricoleur’ is adept at performing a large number of diverse tasks; but, unlike the engineer, he does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project. His universe of instruments is closed and the rules of his game are always to make do with ‘whatever is at hand’, that is to say with a set of tools and materials which is always finite and is also heterogeneous because what it contains bears no relation to the current project, or indeed to any particular project, but is the contingent result of all the occasions there have been to renew or enrich the stock or to maintain it with the remains of previous constructions or destructions.” (Strauss, 1962, p11)

6.8.4 Actors and roles

The researcher has used the term actors earlier in the thesis, to describe staff members at SMEcon. To this he must add all the stakeholders in the project, including DW and DG, SMEsup1 and 2, and SMEnet.

Small-scale bricolage can also be a process by which the decision makers are alerted to opportunities, possibly provoking re-alignment of IS and business strategies. This did not happen due to the decision maker. Also, the end users are crucial as a source of requirements and ideas but again, they were not utilised until after the system’s launch, and even then, only in passing. SMEcon missed the opportunity to gain from their recent external

experiences, especially the new staff who had been employed in other organisations. They could have brought an alternative perspective to the typically, inward facing SME.

7 Discussion

7.1 Introduction

This chapter will provide the discussions to the study as well as describe the contributions to knowledge. It will show the overall generalisation of the project, and how it could inform other SMEs, both within the construction industry, and beyond.

7.2 Learning from Research Projects in SMEs

The main issue, as can be read throughout the thesis, was that an MIS was not adopted. This was not in the control of the researcher or the research team. It was a decision based upon NR's, the project's main sponsor's, feelings on the matter. This type of project development is typical of Action Research cases, where the researcher team is not in complete control of events.

However, the project can be split into three levels of output.

1. The successful adoption of a system into SMEcon
2. The successful learning from the project for SMEcon and other stakeholders
3. The successful learning from the project for SMEs, and other organisations.

	SMEnet	SMEcon	Research Team	Others
Success of the system	Yes	No	Partial	N/A
Specific Learning for SMEcon & Stakeholders	Yes	Yes	Yes	N/A
General Learning for other organisations	Yes	Yes	Yes	Yes

Figure 7.2a - Outputs

The first point needs to be viewed from the different stakeholders' views. From the supplier's technical, DMS creation approach, it was successful. The system was supplied as per the ever changing specification, for which they were fully paid. They were not contracted to ensure the system's full adoption into SMEcon. The researcher also views the system adoption as somewhat of a success, in spite of reservations as to the decisions made whilst working on the project that ultimately led to the system not actually being fully adopted. SMEcon's view is one of failure, and the company is not using the system.

The second point involves the stakeholder learning. The supplier should be able to add the experiences in dealing with NR, the researcher and SMEcon to enhance their understanding of adoption projects. However, with the company, SMEnet, folding one month after the researcher left SMEcon, this cannot be verified fully. It should be noted that the firm's collapse was not due to the project itself, but other personnel factors within their organisation. The researcher was able to have informal discussions with two of SMEnet's former employees, and the general comments made lead the researcher to believe that those individuals who moved onto other similar firms have learnt from this experience.

Within SMEcon, its employees have highlighted various issues that imply that they would 'do things differently' if such a project was to appear in the future, therefore a level of learning has taken place. Whether the alternative 'way of doing things' is any more successful, remains to be seen. The researcher and the research team have copious amounts of detailed information gleaned throughout the project. The main lesson is that it should assist any similar projects, whether grant sponsored or otherwise, in watching for the many pitfalls and opportunities that there may be ahead in such work. It should also highlight the great opportunity gained with cross-departmental/School projects, where the researcher and the team can work out with their usual industry/professional restraints.

The final point is the value of this project to other organisations, whether construction-based, SMEs, or a mixture of both. The overall lessons from this case must be valuable to other organisations. They are not issues specifically with the IT, ICT, MIS, or the DMS, nor with the actual training and usability of the system. Rather, the way the business runs, and all the knowledge that it involves, needed to be quantified and qualified.

The actual process of how the firm works, day-to-day, hour-to-hour and minute-by minute, needs to be known, understood and documented. Installing a system, either paper-based or IT-based, cannot aid the firm in its work, if no-one knows how the firms operates. Of course, in this case, the Commercial Director led the project and the researcher, and the research team, believed that he knew everything that the firm did and when. It was late on in the

project, that it became clear that this was not the case. Another issue was the rate of growth at SMEcon, which increased its office-based workforce by 50% in the project's duration. These new employees brought their own history, experiences and knowledge, and these were not taken into account during the project. The firm should have set out clearly, what the business process was, who did it, how this was done and when. Once these criteria are known and documented, then a system may be adopted.

The Commercial Director's decision to adopt a DMS instead of an MIS was somewhat of a surprise to the researcher. His conversations with, and information on the Commercial Director's, led him to believe that the company would go forward with a full MIS, as per the project brief. Based upon the fact that all three of the owner-directors of SMEcon had around 20 years' experience, including being part of a regional management team of a major national construction and property company, and had 'a wealth of experience in managing a successful regional business for a major multi-national organisation.', the researcher believed that SMEcon would be able to harness these experiences and develop a unique, for SMEs, MIS, tailored to their own way of working.

> *The team decided to rid itself of the shackles of the plc to concentrate on using its skills and experience for the direct benefit for the people who really matter – employees and customers!*
>
> [original website].

Their feeling was that large companies can't change quickly enough to suit client demands and other industry developments due to bureaucracy, complex reporting mechanisms and a 'lack of direct contact' with the clients, suppliers and other stakeholders [Interview with Commercial Director, 19/03/07]. The team stated that they were committed to the 'change agendas' of Latham (1994) and Egan (1998), as well as other more recent developments, to adopt a new way of working within the construction industry. They feel that this should give them a real competitive advantage in the industry. [Interview with Commercial Director, 19/03/07]. These changes include the implementation of a co-ordinated project information system, quality-based tendering, committed leadership, a focus on the customer, integrated processes / teams, a quality driven agenda and commitment to people.

As well as these aims, they had some experience working with specialised software, and the decision to purchase Asta in particular, was based upon NR's previous exposure to its use. He also had a robust plan of how this new way of working would be implemented. Firstly, the Commercial Director wanted to form the new SMEcon system upon 'SMEcon'd forms' – forms that had a common template involving the company logo and standardised code-

numbering system in a set location. The logic behind this was that a paper-based form system, tailored to SMEcon's information requirements, would be an excellent basis upon which to setup an Electronic Management Information System.

However, some initial issues alerted the researcher to potential problems. The first was NR's decision to allow the researcher only to work with him, and no-one else in the company. As a small company, it is often the case that everyone knows a lot about each other's roles and responsibilities but to not include anyone in, nor tell anyone about the work being done, seemed odd to the researcher. This does not seem to be widely discussed in the Action Research field when dealing with SMEs. The omission of researchers working relationships and environments during their research is an issue in itself, as it does nothing to prepare others in how to manage these relationships. The findings show that this is vital information, in order to assist others in their project environments.

Another project-specific issue occurred when the researcher broached the topic of how any electronic system would work. As reported, the Commercial Director did not want to distract from the creation of the paper-based MIS. The researcher also discussed how the management processes would need to be identified and decided upon. Again, the Commercial Director did not want to consider these points at this time in the project. All these issues confused the researcher who felt that this may become an isolated project and process form the rest of SMEcon. This was indeed commented upon during the interviews, specifically from with the Managing Director "...but people I think have ended up feeling like it was yours and the Commercial Director's project or whatever, as opposed to this is for the company if you like.... the Commercial Director's project, that's how people have felt I think." This seems to occur often in the larger workplace. Indeed, the researcher, in his previous working life, has experienced such project isolation issues, where those 'outside' the project team, feel that the project is nothing to do with them. Then, when it is delivered, most resistance comes from those the project isolated. The isolation phenomenon, discussed later under Management, was, naively in hindsight, not going to be an issue with the project, although the researcher did note an unease with the manner in which the Commercial Director kept the project development from SMEcon's staff by keeping himself and the researcher 'out of the way' in the conference room. The researcher believed that this was to allow the Commercial Director to concentrate upon the project specific tasks in hand, without disruption of thought by more operational questions at the time and that the Commercial Director knew all that his organisation required. This, as the findings show, was not the case, especially at the initial launch of the paper-based system.

7.3 MIS and DMS Definitions and Characteristics

The researcher then became aware of NR's vision for the new 'MIS'. It would be a new system that would store the newly created documents in a central repository, available to all staff no matter their location. This was a huge source of consternation with the researcher, as this was not an MIS.

The system the Commercial Director wanted did not even meet this mechanical description of an MIS, as it would not process any information. It was to be a Document Management System (DMS). The researcher observed that this would merely replace the paper-based system in an electronic form, thus not taking advantage of any added-value, processing ability of an MIS. However, the Commercial Director had requested that he have a system that would reduce duplication of paper-work, ensure everyone was working from the same, shared documents and that the security of the system would allow SMEcon to ensure that all staff stored documents where they should be. Both a DMS and MIS can do the tasks requested by the Commercial Director, but do so in very different ways.

This conflict between DMS and MIS adoption has been described before. John McDonald, (1995, p71) noted that people are now able to "easily send e-mail messages to people at all levels of the organization" and "use our own sometimes unorthodox approaches to describe and classify our documents. And when our directories are too full, we simply get rid of the old stuff that we do not need anymore. If we could just remember what that old stuff was." This ad-hoc approach to record management does nothing to enhance an organisation's knowledge management abilities. McDonald (1995, p75) goes on to describe record keeping as an 'after-thought'.

> *We are restricted to providing them with repositories in which they can file documents or "records." The identification or selection of the "record and its storage somewhere is addressed as an afterthought and is not a natural result of the transactions associated with the work activity.*

From here, he starts to provide a potential solution to the problems created by the storage approaches taken so far.

> *Right now my screen is full of icons that represent a "toolbox" of software utilities such as word processing, spreadsheet, e-mail, database, etc. In the future, as a programme manager, I want a screen that contains icons that reflect the business activities that I manage.*

(McDonald, 1995, p75)

This orientation towards a process driven, collaborative system would make much more sense to employees who need to perform certain tasks as projects develop. McDonald

envisaged a system where, when he highlighted a task, it would bring up all the necessary information regarding it and communicate with other parties affected by any work undertaken by completing that task. Thus, the need for saving, forwarding emails, etc., would be redundant. This was based upon research that John McDonald published in 1995 and the confusion and fear of adoption of a storage system, DMS, and a process based system, MIS, is still prevalent in the workplace, as shown in this thesis. It also lends itself to agreeing with Paul's (2007) three main points identified defining IS as a whole:

1. "The IS is not the IT and the formal processes being used.
2. The IS is not the people using the IT and the formal and informal processes.
3. The IS is what emerges from the usage and adaptation of the IT and the formal and informal processes by all of its users."

(Paul, 2007, p 195)

7.4 ICT Adoption in SMEs

This thesis is the result of a project funded through the EPSRC, who have specific demands to allow funding to occur. However, the researcher was fortunate to have supervision and advice from out with his 'home' school. This led him to look at non-construction industry specific research in the adoption of systems. This integration with other specialists must provide more holistic solutions to IT adoptions. In SMEcon, the researcher and users were still learning how to save and store documents, when what was needed was a system that fitted into the organisation seamlessly, as described by McDonald, whilst researching Records Management in 1995. One suggestion that he hinted at was that maybe firms need to create a specific archivist role for all company information, both storage and retrieval, who knows the context of the business and its processes.

The project did not create significant financial benefits in terms of efficiency gains from enhanced ICT systems capability. Indeed, due to the procurement decision by the Commercial Director when employing SMEnet, it increased the cost of the overall project. If the project had been tendered to other firms, with other solutions, it would have encountered more of the questions that weren't asked until cycle three, much earlier. The tendering issue was very surprising to the researcher. Why, when procurement by tendering are second nature in the construction industry, as highlighted in both the Latham and Egan reports cited by the Commercial Director, did SMEcon not follow such a process? This appears to follow the phenomenon known as the 'Cobbler's children', where his own children go barefoot, whilst everyone else can buy shoes. This anecdotal notion appears to have some truth in this case. However, it is too simple to merely attach the lack of process to a known saying. Instead, the researcher believes that the fear of the unknown plays a far larger part. SMEcon

had absolutely no experience in IT procurement and seemed to assume that it was a different process to any other that they had dealt with. This, with hindsight, is strange, as surely buying any value product from a recognised project-based supplier should be managed as such.

Although the isolationist policy of the Commercial Director throughout the project meant that any learning was not spread around the organisation, it did have an indirect positive impact on creating new marketing opportunities for SMEcon. By redeveloping the website, it gave SMEcon confidence that the internet was not a difficult arena on which to create an image. Their previous website was static and required expensive specialists to make alterations, whereas the new site was easily adapted by SMEcon staff. However, the layout, as designed and approved by the Commercial Director was not what the Managing Director wanted and they have since re-launched the website with a different supplier, matching MT's learned vision more closely.

In spite these issues, the research provides some key general points for any Construction SMEs with a view to implementing ICT solutions. Indeed, some of the issues can be applied to any SME.

1. Do not allow one staff member to wholly advise on the project; it must be a representative spread of staff members/stakeholders to represent the whole organisation.
2. Do not isolate your staff from the project. Their assistance will mitigate against resistance to and changes.
3. As a Construction SME, tendering is a way of life; use it to your advantage.
4. Use as many knowledgeable people as possible to gather advice and evidence of similar projects.
5. Use the SME networks professionally, not just who you know directly or through friends.
6. Have a defined process of how your business operates day-to-day that everyone agrees to and follows.
7. As your company develops and grows, make note of the changes in how you work, who does it, and what the effects are.
8. Consider the ultimate goal of the project and understand that ad-hoc changes can be devastating to the aim.
9. Use the project to identify and cultivate the competences within the organisation.
10. Add to the organisation's competences by utilising other peoples' backgrounds and experiences.

These ten points are made with the backdrop of the overall project. At every decision, the researcher was not able to convince SMEcon that there may be other options to those that

were presented. Time is a huge factor in the decision making process, and the speed at which the procurement decision was made may have been driven by the delays in the paper-based system being ready. However, no project plan was in place, and the procurement decision did not need to happen once the documents were ready. It could and should have been done in parallel thus allowing the potential issue to be thought about without rushing into.

This massive change in the project's direction was not controllable by any of the research team, in spite of the previous working relationships between NR, DW and DG. The decision was made and the project had to develop to suit this. This is a major issue for any research project entering into the SME world. Due to resource availability, capability and commercial factors, SMEs find it almost impossible manage complex, long-term academic projects. Larger firms may be able to 'stick to the plan' over the years a research project can take, but SMEs may not.

7.5 The Project's influence on the Study

The research problem for the study was primarily based around one topic:

> *"The lack of business process information in the construction industry, making decisions on management system requirements, identification, design and adoption very difficult."*

Although the study began at the end of September 2006, the researcher did not begin the project element until January 2007, thus beginning four months late as the SMEcon did not have the resources available in order to collaborate due to other work commitments.

The project also lacked some major constituents that, based upon the previous documented work undertaken, should have existed and been applied:

1. No standard operational documented processes or work forms.
2. No independent technical/management/project advice.
3. No project consultation on the ICT solution to be used, although some limited advice given.

These elements were necessary to form an operational basis that the project could then build upon. Added to the above mentioned points was SMEcon's decision not to apply a tendering process when they went to market to purchase an ICT solution.

The full story of how these missing elements directly affected the working of the project are captured in detail through the researcher's diary entries, a sanitised and abridged version of

which are captured in Chapter Five. Two key project outcomes were produced due to these missing elements and processes:

1. SMEcon did not adopt an MIS.
2. SMEcon did adopt a DMS.

This radically altered the aims and objective for both the project and the study. The study analyses what happened in the SMEcon project with a view to answering why it occurred and what this could mean to wider SME communities. The objectives to meet this aim are:

1. Review of the adoption of a new paper-based form library within a small company and its effects on the business.
2. A review of the overall DMS adoption project and the decisions that lead to it.
3. Extrapolate learnings from review evaluation interviews
4. A comparison of this project's process with other documented studies

Another effect of SMEcons decisions during the project was on the chosen methodology. The application of AR in the project was planned to be participative. However, the researcher and his team could not fit the project into the model required. As described by Masters (1995), the project was not predictive, especially considering the main decision not to adopt and MIS. It was also difficult to extract any evidence of social change or issues around equity, mainly due to the lack of comparable cases.

The best AR fit belongs to that of collaboration AR, as described on the next page.

Philosophical Base	Mutual - Collaboration Action Research Historical - hermeneutic
The nature of reality	Multiple, constructed, holistic
Problem	Defined in situation
Relationship between the Knower and Known	Interrelated, dialogic
Focus of collaboration theory	Mutual understanding, new theory, inductive
Type of knowledge produced	Descriptive
Change duration	Longer lasting, dependent on individuals
The nature of understanding	Events are understood through active mental work, interactions with external context, transactions between one's mental work and external context
The role of value in research	Value bounded
Purpose of research	Understand what occurs and the meaning people make of phenomena

Figure 7.5a - Action Research, Adapted from Masters (1995)

This was driven by the lack of any form of control by the research team over the project at key points and most of the study was defined by the situation, rather than influencing it. This led to a descriptive study taken over a long period. The new aim of the study also reflects this approach as it now seeking to understand what happened during the project and what it means.

However, even this model is not an exact fit to the project. Due to the uniqueness of the project and study, it is not possible to draw from other replica projects and studies in this arena as required by the nature of understanding's external context. Any context used in this study is derived from alternative industries or experiences. This is where Mode 2 research adds to the rich tapestry of the project and study.

'Mode 1' knowledge production	'Mode 2' knowledge production
Problems defined by academics and professional communities	Knowledge produced in context of application
Disciplinary knowledge	Transdisciplinary knowledge
Homogeneous sites/types of knowledge production	Diverse sites/types of knowledge production
Research as objective investigation	Research as reflexive/ dialogical
Quality control by 'invisible colleges'	New forms of quality control and required with social accountability

Figure 7.5b - Summary of Mode 1 and Mode 2 ((Swan *et al.*, 2010, p 1313)

> *"given the prevalence of both theoretical and organizational homogeneity in mode 1, it is less likely to produce true social accountability. Also its preference for positivist approaches reduces the likelihood of reflexivity being a key feature of the knowledge production process, or at least the likelihood of this being an acknowledged feature of the research."*
>
> (MacLean, MacIntosh & Grant, 2002, p 205)

This study switched from a potentially objective study to one where reflexivity and social dialogue are facilitated throughout the research process. The control issue of the research was highlighted and Mode 2 is driven by the research problem, (MacLean, MacIntosh & Grant, 2002, p 205)

7.6 Context, Methodology and Theoretical Frameworks

A social research project cannot work in isolation. The environment into which it exists is vital, as is its previous influences and its final outcomes. The researcher added Chapter

Five, Historical Context in order to give an idea of where the project derived. The three key elements in the pre-research work were:

1. NR's historical approach to project implementation through the adoption of Risk Management to his previous organisation,
2. DG and DW's existing ties with SMEcon, and the Commercial Director in particular,
3. How SMEcon arrived at the point immediately prior to the research study.

All of these elements were important in the way SMEcon and the researcher worked together subsequently. It is the researcher's view that these formed and influenced the relationship and decision making process shared throughout the project. This, allied to the researcher's own experiences, expertise and personality shaped the project fundamentally.

The action research (AR) approach was considered to be the most appropriate for the situation for three reasons:

1. As a small company, SMEcon did not have the resources to assist with an academic study.
2. As a small company, SMEcon did not have the either the personnel or financial resources required to implement the project unaided.
3. In the original ESPRC letter from SMEcon, AR was given as the method which the project would use.

Action research 'favours consensual and participatory procedures that enable people (a) to investigate systematically their problems and issues, (b) to formulate powerful and sophisticated accounts of their situations, and (c) to devise plans to deal with the problems at hand'(Curry, 2005: p.2). The issue that the researcher had with this approach was due to NR's initial reluctance to involve more people. Had he included other, knowledgeable staff, the researcher believes that many issues revolving around the paper-system's re-working after its launch, would have been avoided. Also, by involving the rest of the staff, the issue of ownership would not have occurred to the extent it did. It would also have allowed the researcher to use his own skills in understanding the company's working environment. This is also key to AR, as the researchers' role is critical in any study undertaken. The reflexivity, verification and validity of the study are driven by the researcher's approach and reporting of the 'story'. "What is important is that the reflection is adapted to one's own personal abilities, the context of the problem being investigated, and to the perspectives of the stakeholders directly affected by the research project being undertaken." Van De Ven (2007)

One element not described often in AR is the differing roles that may be required of the researcher at any one time. He wasn't only an observer, as many social science researchers are, nor was he the only 'human' component in the experiment, as can be the case in

laboratory driven research. Some of the roles were conglomerations of activities. For example, he was an observer during the initial SMEcon - SMEsup meeting but was also an advisor and eventual lead for the communications throughout that portion of the project, all while being an academic with the brief of the PHD in his mind.

When adding context to the methodology, AR, and adding these roles; the overall effect is much more complex than the AR writing would have you believe. (See Appendix B, Figure A)

The figure shows each cycle represented by a circle. This is the researcher's 2-d representation of the idea of depth, with the depth implying differing roles that the researcher undertook within each cycle.

The action research methodology does not allow for external drives deviating from the planned course of action. In Cycle 2, NR's decision in procuring the DMS did not include any of the research team and was made very quickly. The AR cycle basically ended at this point, and moved onto the next process,

	Description	Researcher Role
Cycle 2 – Observation	Based upon the newly created and released forms, the ICT system was discussed. The researcher was asked about ideas, and argued for a database derived system, in order to make process efficiencies and remove duplication. The Commercial Director said he 'wasn't comfortable' with this and wanted to implement a document repository type system, replicating the structure already in place within the firm.	Team member Expert – IS user training
Cycle 2 – Reflection	Thoughts on how to recreate the paper system into an electronic version – the 'golden rules' Primary end-users = Site managers No possibility of document over-writing No possibility of document erasure Simple, 'light-touch' site for identified end-users Automatic numbering system based upon time and date of document upload This is the system everyone will use to store and retrieve all documents.	Team member Guardian of 'golden' rules adoption
Cycle 2 – Action	DW was asked to evaluate the existing IT system with a view to updating/replacing it to suit the requirements.	Team member
Cycle 2 – Evaluation	The system evaluation and recommendation report by DW and DH was submitted in December 2007.	Team member and advisor to DW and DH
Cycle 2 – Modification	The modification in this cycle took an unexpected twist, with the Commercial Director receiving advice from SMEsup2 regarding	Team member

	SMEnet, which he procured after one meeting involving the researcher and SMEnet's initial contact. The new system did not go through the AR cycle until it's adoption, in Cycle 3	
Transition 2	There was no transition as Cycle 2 stopped.	

Figure 7.6a - AR Cycle Descriptions

However, the Social Construction of Technology framework did allow the researcher to make sense of the process within the company. This, allied to technological frames, gave an insight to how the new systems were perceived and why. It added more context, as the researcher was able to draw out the employees' experiences with other technologies, or their definitions of them. By constructing the semi-structured interviews, the project was finally able to tell the story of the whole project, using different peoples' viewpoints to focus in on the important issue faced during the system's adoption. The fact it wasn't an MIS as defined earlier, did not seem to affect the users, except that they appeared annoyed that they were now doing more tasks in order to manage the information.

In order to investigate SMEcon's post adoption results, the researcher reviewed the SCOT literature to ensure that the structured questionnaire would answer the pertinent areas of concern. He wanted to get and insight on the three core areas of the methodological framework:

Does the 'technological artefact' have different meanings and interpretations for various stakeholders? The technological artefact was split into two, the 'MIS' and the ICT as the researcher wanted to know if people perceived there to be a difference between the two. Originally, this shifted the focus for the explanation of scientific developments from the natural world to the social world. In this case, the researcher applied this focus shifting idea from the specific working environment of what MIS and ICTs were to that of a more 'socially' accepted one. It was argued that although interpretative flexibility can be recovered, it soon disappears in science; that is, a scientific consensus as to what the "truth" is usually emerges.

Had the description of the artefact been stabilised? Closure in technology involves the stabilisation of an artefact and the removal of any problems.

Rhetorical Closure is that the closure of a technological "controversy," need not actually solve the problem. It only requires the relevant social groups to see that the problem has been solved

Closure by Redefinition of the Problem is much more complicated, in that it solves one problem, by inventing another, which is then solved.

The third stage attempts to relate such "closure mechanisms" to the wider social-cultural milieu. The researcher, based upon the conversations during the interviews, attempted to glean a contextual, social discussion where the subjects were asked to relate their experiences with the artefacts' adoption to their own overall experiences, whether in previous work or home life. This socialisation, once identified, should alter the subject's ideas of the artefacts.

The first section of the questionnaire, shown below, dealt with focusing the interviewee's answers to the specific system. The first question provides a quantitative response, which was then enhanced by asking about the interviewee's reasoning and finally, asking about specific examples.

The next section specifically investigated the interviewee's knowledge of what an MIS was. The researcher decided to stay with the term MIS, as this was the original plan of the project. He felt that DMS would not be as recognisable to people out with the IS field. It goes on to question whether they understand its function, and ask what their assumptions about its adoption were before it arrived and whether it met their expectations' once adopted. These questions were then asked about ICT, in the same manner.

The big issue with asking these types of questions is that, once asked, the interviewees may now have a slightly different response compared a one-off, matter-of-fact question by someone better known to them. The researcher, by asking the questions, has impacted upon the interviewees' responses. To try to mitigate this problem, the researcher kept the discussion going and asked about more personal experiences with systems and ICT, with the aim of depolarising the employees' answers to tell what answers they felt may have been expected.

The final section asked the interviewees about their impressions of how useful the two artefacts were, or whether they were not necessary at all.

Interestingly, out of the nine staff, not including the directors, four were not using the system at all, two members were using it, and the final three were using it in part, mainly due to access and operability issues. Remembering that the researcher had exited the company and these interviews were being held in July 2009, some five months later, it seemed astonishing that the take-up of the system was not total. Only one person, the Project Manager, noted his lack of access to the system and most commented upon the perceived

speed of using the system at one stage or another. Even the users who claimed to use the system regularly, admitted to not using the system fully.

The questionnaires also revealed other contextual issues involving interesting 'work-a-rounds'. One manager re-used existing forms, with the appropriate addresses, to save on typing and retyping information request to his suppliers. This was not planned for in the DMS, but would have been dealt with using an MIS. When asked about his own responsibility to creating and managing his section of the system, the researcher was able to confirm one of his fears; that the system and its adoption was independent of the users and they did not have any control, or desire to control, the system as adopted. This must be in relation to the overall projects flow, with the Commercial Director's decision making at the fore.

This was an astonishing revelation to the researcher. The DMS was meant to be the central repository of all standard forms yet no-one seemed to have grasped this, and were continually working around the system, in this case, by regurgitating used forms to save time on typing. None of the users felt the system was overtly useful. It seemed to be a good idea, but poorly understood or executed. It was mainly used a s a source of standard documents. This indeed was an initial feature of the system, but it was certainly not the overriding one. However, the users did not feel the system was useful for anything else. The researcher notes how this impacts on Checkland and Howell's (1999, p 91) criticism of current IS literature "not being able to give a clear and coherent account of the field. Even the most basic concepts like, data, information and knowledge lack agreed upon definitions." These 'out in the field' differences are difficult to note as the users do not understand importance of the academic distinctions. Indeed, describing the variations could impact negatively on the research questions by retuning their focus onto the said differences, at the expense of the overall responses required for the study. The balance is a difficult one to manage and has to be done on a case-by-case basis.

The second main section of the questionnaire dealt with the staffs' understanding of an MIS. As mentioned in chapter seven, the system was not an MIS, but a DMS. However, the phrase DMS is not as well known to those outside the IS filed, and the researcher felt that this may add another level of communication difficulty that was not appropriate at this time. The researcher did not coach any interviewee in this questionnaire and, as such, feels the language used by the respondents is vital in understanding their assumptions, observations and knowledge on the subjects queried. The researcher carried out the same questioning regarding ICT.

The responses were variable, but none really described either MIS or ICT as per the academic notions. This, the researcher posits, is due to the employees not being specialists in either field, rather they are educated and employed in the field that they work in. The manner in which they described their experiences with either MISs or ICTs, showed that they saw them as things that they had to use and do their work with, in order to keep up with others. This was especially prevalent when the employees were asked if they could do without either MIS or ICT.

Overall, there is an assumption that it is not possible to work in today's construction industry without the aid of MIS or ICT. However, the reliance on the systems appears to be marred with a level of distrust, with various groups keeping 'hard copies' of records, thus duplicating documents or their parts. This may be a specific issue with the adopted system itself or the training in its use. However, it could be due to 'tradition', where people are so used to 'how they do things', that any new system will have difficulty in totally removing incumbent behaviours. The framework's achievements are summarised thus:

- Does the 'technological artefact' have different meanings and interpretations for various stakeholders?

It appears that both the technological artefacts did have different meaning to various stakeholders. This is mainly due to the SMEcon staff not really thinking about what tools they were using in the same way as each other.

- Had the description of the artefact been stabilised? Closure in technology involves the stabilisation of an artefact and the removal of any problems.

Rhetorical Closure is that the closure of a technological "controversy," need not actually solve the problem. It only requires the relevant social groups to see that the problem has been solved

Closure by Redefinition of the Problem is much more complicated, in that it solves one problem, by inventing another, which is then solved.

The researcher believes that rhetorical closure did not happen across all the staff. Due to the nature of SMEs, there rarely is the opportunity to form groups in the manner of larger organisations. There are no departments, such as Human Resources, Procurement or IT, therefore these groups cannot gather, making social grouping in their specialist silos impossible. However, as a company, they can group socially, making the fact that rhetorical closure did not happen all the more concerning for the company-wide adoption of the artefacts.

The third stage attempts to relate such "closure mechanisms" to the wider social-cultural milieu. The researcher, based upon the conversations during the interviews, attempted to glean a contextual, social discussion where the interviewees were asked to relate their experiences with the artefacts' adoption to their own overall experiences, whether in previous work or home life. This socialisation, once identified, should alter the subject's ideas of the artefacts.

This process was very difficult, and may have happened partially with some of the respondents. As each interview developed, the researcher became aware that some of the interviewees were beginning to think about the artefacts slightly differently from when it started. This awareness was especially prevalent in the interviews with Construction Manager and the HSE Manager, the oldest staff members. They both were able to discuss the system in relation to others used and to their own experiences of leaning about them. Both Construction Manager and the HSE Manager seemed to have a settled idea of what the system was and how it fitted into the environment within which it worked. They were also able to discuss why it wasn't working and the basic issues preventing its full use.

However, they were not able to discuss the technology strategy. This was mainly due to the Commercial Director not allowing anyone else into the initial project discussions. Indeed, even the Managing Director seemed to be side-lined in the process. This strategy should have been aligned with the overall corporate strategy. To find out, the researcher interviewed NR, the Commercial Director and MT, the Managing Director. They were asked two questions:

- "Why did SMEcon need an MIS/Document Repository?"
- "What is the overall purpose of the system?"

They both discussed standardisation, process across the company and allowing others to understand what they do affects others and how. However, the Commercial Director was more interested in control. He perceives the system as a mechanism to reign in processes that are not necessary to the operation of the company, as he sees it. This may be due to his own perceptions of events in July 2006, where two employees left the company with all the information they had gathered whilst working in SMEcon, leaving nothing behind. They both felt the system adopted did not meet these criteria.

Their responses were really split into two areas;

- The ICT abilities/usage
- The system structure.

During the system development, a ‘saving issue’ had arisen, where to use a document, meant it had to be saved on the users’ computer, used (filled in), then saved again before uploading onto the system. This was a direct issue with the software bought, and there was no technical solution to this. The Commercial Director was upset at this, as he felt it undermined the control over the users as to what they could do with the documents. The researcher felt that this could be circumvented by education and training. If the saving process was made into part of their process, then it should not be an issue.

The second issue was around the complexity of the filing system. Both new the need for as simple a system as possible, but also acknowledged that the one now adopted, was not simple. This was independent of the ICT-based system.

They were then asked about the drivers of the system. The Managing Director clearly felt that the system’s main stakeholders were represented by the two people who left the organisation, taking the information they had, and starting a company themselves. These ex-staff were mainly based in the office and ran the projects from there, with regular visit out to site. This was in stark contrast to the Commercial Director’s original system design of ‘from the bottom up’, where the site-based employees were the most important. The Commercial Director felt ‘badly advised’ in taking this path. He also mentions the issues with the company’s growth, and its structure being added to by a management level. However, as the researcher has noted, this was a key area that the Commercial Director had been advised on during the summer of 2006, long before SMEnet was brought into the project. The Managing Director felt that a system was essential, but did not go into details. The Commercial Director admitted his mistakes.

Overall, technological frames and the use of SCOT were very enlightening, and gave great structure to a difficult project. It stabilised the project whilst allowing the actors to have room to make their observations freely whilst keeping the whole process contextually relevant. The researcher feels that context is vital when investigating standalone projects, as there are many outside factors that will affect them.

A major contribution to knowledge that the researcher is able to make involves the application of the AR methodology, being used along with the SCOT and adding a contextual glue to both. Also, the initial AR model, participative, had to be rethought due to actions taken during the project, meaning the researcher had to change his modus operendi to suit the organisation rather than have a more collaborative function.

Both AR and SCOT have difficulties in being utilised alone, especially when investigating SMEs. The contextualisation of the whole project allows researcher to manage the uncontrollable elements, such as owner manager decisions, whilst stabilising the research itself in order to give a meaningful outcome. The general lessons learned and described in this thesis are applicable to other SMEs. However, there are some that may be specific to Construction SMEs, due to the industry make-up.

The application of AR in the project was planned to be participative. However, the researcher and his team could not fit the project into the model required. As described by Masters (1995), the project was not predictive, especially considering the main decision not to adopt and MIS. It was also difficult to extract any evidence of social change or issues around equity, mainly due to the lack of comparable cases.

The best AR fit belongs to that of collaboration AR, as described below.

Philosophical Base	Mutual - Collaboration Action Research Historical - hermeneutic
The nature of reality	Multiple, constructed, holistic
Problem	Defined in situation
Relationship between the Knower and Known	Interrelated, dialogic
Focus of collaboration theory	Mutual understanding, new theory, inductive
Type of knowledge produced	Descriptive
Change duration	Longer lasting, dependent on individuals
The nature of understanding	Events are understood through active mental work, interactions with external context, transactions between one's mental work and external context
The role of value in research	Value bounded
Purpose of research	Understand what occurs and the meaning people make of phenomena

Figure 7.6b - Action Research, Adapted from Masters (1995)

Due to the lack of any form of control by the research team over the project at key points, most of the study was defined by the situation, rather than influencing it. This has led to a descriptive study taken over a long period. The new aim of the study also reflects this approach as it now seeking to understand what happened during the project and what it means.

However, even this model is not an exact fit to the project. Due to the uniqueness of the project and study, it is not possible to draw from other replica projects and studies in this

arena as required by the nature of understanding's external context. Any context used in this study is derived from alternative industries or experiences.

SMEcon ultimately failed to meet their own ways of working, as the industry is so fragmented and fluid. Their corporate aim of working "closely with customers to fully understand their requirements, aspirations and priorities" where "information is openly shared and customers are encouraged to pass responsibility to manage their property and construction projects, using their in-house experience and expertise" does not fit with the approach taken by the Commercial Director throughout the project. The researcher feels that the employees should, at least, have been seen as customers, with information and discussions on the project's development being communicated. They also wanted SMEcon to "rid itself of the shackles of the plc to concentrate on using its skills and experience for the direct benefit for the people who really matter – employees and customers!' [original website]. Again, this was not possible. The issue here was that the company was working within the construction industry, and had to conform to those rules.

7.7 Strategy

In Chapter 2, the researcher discussed some writings on Strategy, specifically those surrounding IS adoption and SMEs. Indeed, "successful IS adoption is more likely if SMEs already have an explicit strategy" (Levy & Powell, 2000). However, the problem for many SMEs is that business strategy often is implicit and emergent .(Levy, Powell & Galliers, 1999). The researcher also noted work by Mintzberg & Waters (2006).

Entrepreneurial	Strategies originate in central vision: intentions exist as personal, unarticulated vision of single leader, and so adaptable to new opportunities; organisation under personal control of leader and located in protected niche in environment; strategies relatively deliberate but can emerge

Figure 7.7a - Summary description of types of strategies (Mintzberg & Waters, 2006, p 270)

When combined, the strategy of an SME can be shown thus:

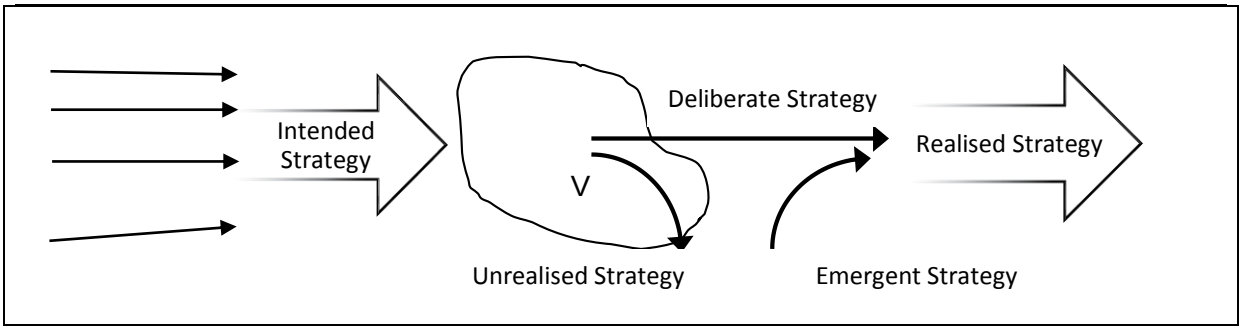

Figure 7.7b - Types of Strategies, adapted from (Mintzberg & Waters, 2006, p 258)

The figure above shows the proposal that the entrepreneur has to create the Intended Strategy at that point in time. However, due to the nature of this strategy, there is a huge potential for the Unrealised Strategy to become the over-riding strategy, making the eventual Realised Strategy completely different, as the route has been severely deviated from.

7.8 Management

Cragg (2002), Fraser et al (2003) and Caldeira and Ward (2003) all discussed competencies and resources within the organisation and its effect on the successful adoption of ICT, specifically within SMEs. Southern and Tilley (2000) also commented on the dearth of research on small firm adoption of ICT and that a common cause of problems is the lack of understanding of small firm context and culture. The approaches attempted applied standard IT management methods, systems analysis and development techniques, within a context for which they were not originally designed. They posited that such technologically deterministic approaches may be inapplicable to loose and unstructured organisations where there are low levels of IT skills and experience and which are highly centralised in terms of decision making – usually with power vested in the owner manager of the small company. The WestFocus consortium also found that the ICT 'supply-side' and government policy. were viewed as 'area of market failure' in spite of the support for SMEs being 'a key policy aim of successive UK governments' (WestFocus Project Team, 2005). The author would add another factor into these views, based upon the project undertaken.

NRs initial isolationist approach to the project ensured the researcher was not able to measure the competence-based factors within the organisation's population. This management approach to the project was surprising to the researcher as SMEs traditionally are flexible in their activities, where everybody can cover most eventualities, mainly due to resource restrictions. SMEcon showed sign of being more structured than initially thought, with the identification of people assigned to distinct departments within the organisation. This management approach appears to be driven by NR's experience of the large firm he had

worked for previously. Also, SMEcon had applied for, and received, academic assistance in the project, showing an understanding of SME policy driven by Government, although not necessarily in the manner in which the policy implied.

7.9 Relationships

The relationships between various project members did affect the project in some subtle ways. The Managing Director and the Office Manager's relationship made communications within SMEcon's office environment most interesting. This reflects a typical SME issue, where personal relationships, however professional the people may be, directly affect the office dynamics. The relationship between SMEnet contact 2 and the owner failed after the researcher left SMEcon, causing SMEnet to fold as a company. Initially, another company took over the contract, using some of the staff it incorporated from SMEnet's demise, but the researcher understands that this has since ended too.

The relationship between the Managing Director and the Commercial Director is puzzling to the researcher. They have a long-term working relationship from their previous employments. However, although the Managing Director was the MD of SMEcon, the Commercial Director was leading the adoption project, with, what appeared initially, as little or no direct input from the Managing Director. It wasn't until very late on in the process, that the Managing Director became more involved. After the interviews, the research was able to note frictions between them. the Commercial Director has since left SMEcon.

The researcher was also aware of DG, and to a lesser extent, DW's relationship with the Commercial Director, NR. Obviously, this had some roots in the previous research and projects done together, but the researcher still felt that this affected his behavior when discussing SMEcon related issues, either with the Commercial Director, or DG. The researcher feels that this occurrence can, if not managed properly, have a serious effect on the research itself. In this case, it was managed very maturely and did not affect the research outcomes.

The researcher also had to manage his academic work load, which included many taught seminars, as well as conference paper writing and presentations. He was also managing a unique relationship within his educational establishment. Although the primary researcher was based in the School of the Built Environment, he had a supervisor in the School of Computing, Engineering and Information Sciences. This involved two very different methodological approaches and knowledge bases. When combined with the commercial pressures of SMEcon, as well as the researcher's own bias and background, it formed a

very complex mesh of ideas and opportunities. This gave the researcher some freedom in methodological approach, in spite of the study already being an Action Research project.

7.10 Research Design

The framework design was, corresponding with the project, very experimental. It was shaped by outside influences. Traditionally, in AR, the observer/researcher looks only to the core cycles. For this study, the researcher was not just that; he was also an advisor, leader and guardian. This meant his role had much more depth to IS and thus, required a wider view of the problem. It was very apparent at the earliest stages of the project that the researcher needed to understand from where the project originated. (See Appendix D – AR cycles in action)

Due to the researcher's world view, constructionism, he had to understand the language that was being used, in order to create a common understanding of all the issues. He went back through historical information from SMEcon, including the previous projects, and married it to his own work history and experience, creating an understanding of the context of the project. During the building of this contextual history, the researcher was exposed to facets of the organisation's history not directly connected with the research project. However, by using some ideas and tools he had investigated, the researcher was able to piece together a coherent, relevant and focused contextual history for the project. The use of bricolage was fundamental in bringing the history forward and adding the depth to the action research project. It is the marriage of bricolage, Action Research and SCOT approaches that combine to produce the distinctively novel methodological paradigm that underpins this research project.

8 Conclusions

8.1 Introduction

This chapter will provide the conclusions of the study as well as describe the contributions to knowledge. It will discuss the overall project in a more generalist manner, listing the key elements that are new contributions to knowledge to the larger field of research in DMS and MIS adoption in SMEs, including those in the Construction Industry.

8.2 Aims and Objectives of the study

The research problem for the study was primarily based around one topic:

> "The lack of business process information in the construction industry, making decisions on management system requirements, identification, design and adoption very difficult."

This proved to be the case at the earliest opportunity both the project and study's timeline. The study began at the end of September 2006 however the researcher did not begin the project element until January 2007, thus beginning four months late, as the SMEcon did not have the resources available in order to collaborate due to other work commitments.

The project also lacked some major constituents that, based upon the previous documented work undertaken, should have existed and been applied:

1. No standard operational documented processes or work forms.
2. No independent technical/management/project advice.
3. No project consultation on the ICT solution to be used, although some limited advice given.

These elements were necessary to form an operational basis that the project could then build upon. Added to the above mentioned points was SMEcon's decision not to apply a tendering process when they went to market to purchase an ICT solution.

The full story of how these missing elements directly affected the working of the project are captured in detail through the researcher's diary entries, a sanitised and abridged version of which are captured in Chapter Five. Two key project outcomes were produced due to these missing elements and processes:

1. SMEcon did not adopt an MIS.
2. SMEcon did adopt a DMS.

This radically altered the aims and objective for both the project and the study. The project's objectives were now:

- To design and adopt a paper-based standard form library that is based upon desired working processes within SMEcon.
- To apply this model to a newly purchased DMS, including configuration of the DMS's workflow system.
- Adoption, user training and rollout of the DMS across SMEcon.

The overall aim was for SMEcon to have an operational DMS across all users that would create an efficient, standardised workflow model to manage their document processes. This statement was never explicitly made during the project.

The aim of the study have also changed completely.

The study will analyse what happened in the SMEcon project with a view to answering why it occurred and what this could mean to wider SME communities. The objectives to meet this aim are:

- Review of the adoption of a new paper-based form library within a small company and its effects on the business.
- A review of the overall DMS adoption project and the decisions that lead to it.
- Extrapolate learnings from review evaluation interviews
- A comparison of this project's process with other documented studies

However, the project developed a new pathway. Different decisions were made when compared to initial thoughts. As highlighted in Chapter 3 - Methodology, this was an Action Research project, with both the researcher and the organization learning about various issues as the project progressed. Indeed, the project followed the form of an Analytic Auto ethnography as it met the five key features as described by Anderson (2006). Also, and more importantly to SMEcon, they ended the process with the system they procured, working exactly to their specification. The project has also produced this thesis, with the researcher able to publish the anonymised details with the aim to gaining a research qualification, as well as presenting at various conferences in both the Construction and IS research fields. However, with the project deviating from its intended course, it has also contributed some other unplanned insights to the field of study.

8.3 The Contributions to Knowledge

In order to identify the contributions to knowledge of this thesis, the researcher must strip out the specific practical issues from the case and highlight the overarching themes that can be drawn. There are two identifiable areas that can be aligned to the main aims of the project; IS adoption in Construction SMEs and AR techniques in SMEs.

8.3.1 IS Adoption techniques in Construction SMEs

The practical contribution involves the lessons learned from the actual adoption of an Information System into a small construction company.

1. Understand the industry's issues.
2. Understand the project's place in the business.
3. Know your (the researcher's) place.
4. Know your stakeholders.
5. Manage the project's output capabilities.

8.3.2 The Construction Industry

The construction industry is fragmented, with silos of information, knowledge and processes given added validity by professional organisations such as the Royal Institute of Chartered Surveyors (RICS) and the Royal Institute of British Architects (RIBA), to name two. These bodies promote their importance to the construction industry and their members. However, these professions do not represent the vast majority of construction workers i.e. site-based workers, such as bricklayers, joiners, plasterers, electricians, etc. Many of these workers are self-employed or work for SMEs, which are sub-contractors with little individual power or influence. Many of the suppliers are not represented either, apart maybe from the Architects. Indeed, construction management, where these bodies are mostly represented,

> *"deals with the ideal, building the structures on paper. The workmen in the field are absorbed with the messy process of getting the work done, of making mistakes, of fighting bottle- necks and bad weather, of having to bare their emotions and tempers, as well as using politics and exchanging favours to accomplish their tasks. The engineers' and managers' view of the project is very fuzzy, based on their limited, idealistic notion of what is supposed to happen according to procedures and paperwork. The actual behaviour does not at all correspond to management's view and can only be understood by examining the activity of workmen in the bowels of the building, in the meetings between the men and their foremen, in the conversations between superintendents and the craftsmen"*
>
> (Applebaum, 1982, pp 225)

These behaviours may not be restricted to the construction industry only. Indeed, wherever there are professional organisations, there are silos of knowledge and processes pertaining to that organisation's members.

This all has a huge effect on the industry's competences. If the industry remains in silos, and is non-inclusive of all the stakeholders necessary to have an industry, how can it grow and mature into a holistic entity? This has been noted with the introduction of a new technology, BIM. Although most recognise that it is a worthy development, as seen by the proliferation of

education establishments suddenly promoting their expertise on the topic, the industry is not quite as quick on its uptake. Obviously, new skill-sets need to be identified and trained out, but it may be that the design of a building now includes all the material planning problem solving done by specific workers. The researcher has identified two stakeholder groups affected by this technology; professionally supported Surveyors and non- professionally supported site-based workers. The researcher posits that the technology advances in BIM are not welcome due to the potential negative effects on jobs and roles. This cynicism towards the effects of technology is a significant factor in the lack of IS adoption within the Construction Industry.

Most stakeholders, including those in SMEcon, acknowledge the necessity of technology in the workplace, but not any more advanced that aiding communications and storing information in their own manner. The Commercial Director himself did not feel that SMEcon needed an IS system and with his previous work experience within construction, it is not too much to suggest that this view is generally indicative throughout the industry. These issues must be addressed if the construction industry is to mature, or IS adoption will not be an expedited process.

8.3.3 Understand the project's place in the business

In any organisation, many issues are being dealt with. In large firms, there are departments responsible for specific business areas, such as Human Resources, Payroll, Purchasing, etc. the list goes on. SMEs tend not to have these specific departments, as the resource issues are too costly and not really necessary for the volume of tasks being undertaken. However, and SME that is growing must pass a transition, where the idea that everyone can do most things has to change. A structure begins to form, and suddenly, people are responsible for specific tasks. SMEcon had just done this; they had a buyer, an estimator, surveyor, finance people, etc. depending upon the IS being adopted, it will affect these departments in differing manners. If it is a financial system, it is reasonable to posit that Finance will be involved heavily, but that Design may not. In an newly structured SME, this is more complicated as the staff still have recent memories of unstructured operating, causing some negativity towards a project that they feel they should be involved in, but are not. These organisational behaviour issues can affect the progress, and even success of a project. SMEcon's approach was to keep the project away from everyone, except the sponsoring director. This caused many issues;

1. Incorrect identification of the main stakeholders,
2. A lack of input from the key stakeholders,

3. A lack of input from experienced employees now working in areas not directly affected

These factors contribute to a lack of understanding where the project sits within an organisation. It also negatively affects project governance, as the stakeholders that will ultimately utilise the IS system, have not had any input into the business requirements of the system, and its operation. All of these factors need to be mitigated in order for the correct stakeholders to have the appropriate level of input, thus governance, for the adoption, as well as giving the project a defined location within the overall organisation's operation.

8.3.4 Know your (the researcher's) place

As an action research (AR) project, the researcher is at the very centre of the work. This is very different from Mode 1 styles of research and investigation, where the researcher and the team have defined the problems, and all are very well qualified within a narrow band of competences. AR cannot operate in that manner. Context is vital. Questions such as 'where did the problem first appear? And what is the problem? Need to be asked. This could, through the many different and unexpected issues that may arise from these questions, require a broader, transdisciplinary knowledge base to investigate. In this project, the researcher's own context was seen as a benefit to the project, as well as the research team's contexts and knowledge. It is important that such a team is available at periods through AR in organisations.

8.3.5 Know your stakeholders.

Stakeholders are critical in any project, whether it be research or new product development; without people, there is no project. However, stakeholder identification and classification is not a simple process. One lesson from this project is, just because the person sponsoring the research says that something is right, it does not necessarily mean that this is true. Opinions are formed by everyone and these may not reflect the way things are. There are many pitfall that the researcher fell into during the AR process in SMEcon, and stakeholder classification was one that was not investigated until much too late in the project's life. In this case, this was not totally the fault of the researcher, but rather the conditions placed upon him at the beginning of the project. These should have been more robustly questioned, but were not.

8.3.6 Manage the project's output capabilities.

Industry and academia work at differing paces. Companies must work to at least keep up with customer demand, and if possible, lead customers into other, profitable areas.

Academia requires thinking time. This may be a quick process for the individual researcher but, due to the vagaries of the more bureaucratic academic arena, this may not transpire at quite the speed wished for. There are many good reasons for this enhanced rigour including peer review and reflection of points not considered. In this project, some delays were caused by personal factors that can affect any person in any walk of life.

The main learning from this is to keep focused upon what was asked initially. There may be developments along the way e.g. not adopting and MIS, but the researcher must be able to produce an output that can tell the story in a rigorous and structured manner. AR also has the practical output of doing the project that the organisation wished for. By keeping these in mind, the outputs will provide a coherence from which the project can be measured.

8.3.7 AR techniques in SMEs

Action research in SMEs requires an approach that appears to be inherently different to those discussed in larger organisations. The researcher becomes the hub of the project, just as per larger firms, but as this is a resource-limited SME, they also become central to stakeholders that are running the whole organisation. That is not to say the researcher is 'controlling' the company, but they are now receiving and disseminating information from the whole organisation.

This could give great power to the researcher who, if not careful, could seriously undermine or disrupt the very organisation in which the project is placed. In larger firms, the effect would be less obvious, as there would be several layers of management involvement. This potential could be turned to the benefit of the organisation too, if the researcher had that type of experience and knowledge with which to influence. None of this must happen. The researcher must focus solely on the project on hand and take themselves out of the business mêlée by grounding themselves into the academic side as often as possible; otherwise the phrase 'going native' may be labelled towards the researcher.

Another technique for the researcher in these projects is to avoid mentioning the fact you are an academic. Company employees, and other employed stakeholders, do not wholly feel comfortable with this notion, which may be a UK specific cultural phenomenon. This may be one reason that the Commercial Director did not introduce the researcher to the SMEcon employees sooner.

The final technique gleaned from this project is that the researcher must not be afraid to utilise their own contextual learning so far, whether they are academic or work sourced. Issues, people, projects and problems do not come without history, and this must be at least

acknowledged, if not fully explored. Utilising bricolage and other research methods will aid the success of a project, and prevent it from being a never-ending AR project.

8.3.8 Method and Methodology

This project has two clear areas of study; Small and Medium Enterprises (SME) in the United Kingdom (UK), specifically in the construction industry, and Information Systems (IS) adoption. Within these fields, academics, mostly Management School or IS specialists, have built theories in order to explain the actions, interactions and non-actions taking place within their studies. By combining these two areas, the researcher looked to both 'camps' in order to find a suitable framework that can explain the events that took place. This collision of two differing paradigms provides a real knowledge contribution.

The key to this was the researcher's stance; Social Constructionism. The built environment is often planted from a Positivist approach, where there is a predetermined knowledge of both the problem to be rectified and the process about to be undertaken necessary before any project begins. This project did not begin in this manner. This is where the researcher and their context was vital. The researcher argues that no project can be seen wholly independent of its environment or history; this is the same for the researcher tasked with studying. These two histories must influence each other, providing a project path that cannot be known before it has begun. Also, the language of the histories must connect and this was certainly the case with this researcher and the project. If these were not important, why would the researcher need to provide Curriculum Vitae information other than that of their academic grades and suitability before being accepted into the research team?

Once the project commenced, the researcher then had to structure the research in such a manner that the full journey of SMEcon could be represented clearly. This research framework was finally settled upon with the application and adoption of SCOT and Technological Frames. From this, the researcher was able to devise a tool to measure the thoughts and reactions of the SMEcon employees, in order to balance out any potential bias towards the project's success, or otherwise.

This innovative approach is enhanced by the researcher use of Bricolage. By utilising all of the 'tools' from his own history and experience, as well as those of the research team, the researcher is able to fashion a cohesive, rigorous and validated study that has the depth of a traditional Action Research project aligned to repeatability brought by the benefits of SCOT and the focus of Technological Frames.

8.3.9 IS adoption in SMEs

This project did not adopt an MIS but rather a Document Management System. Ten key lessons learned during the study are:

1. Do not allow one staff member to wholly advise on the project; it must be a representative spread of staff members/stakeholders to represent the whole organisation.
2. Do not isolate your staff from the project. Their assistance will mitigate against resistance to and changes.
3. As a Construction SME, tendering is a way of life; use it to your advantage.
4. Use as many knowledgeable people as possible to gather advice and evidence of similar projects.
5. Use the SME networks professionally, not just who you know directly or through friends.
6. Have a defined process of how your business operates day-to-day that everyone agrees to and follows.
7. As your company develops and grows, make note of the changes in how you work, who does it, and what the effects are.
8. Consider the ultimate goal of the project and understand that ad-hoc changes can be devastating to the aim.
9. Use the project to identify and cultivate the competences within the organisation.
10. Add to the organisation's competences by utilising other peoples' backgrounds and experiences.

These are very practical, and not specific to IS projects. They are vital to understanding why academic theories may not be valid in the field. Theories should be built upon observation, logic, reason, rigour and repeatability. This study shows that decisions made in industry are not always logical, reasoned, rigorous or repeatable. Indeed, even the context and history prove to be no predictors in decision-making behaviour. This must pose other questions when looking at SME organisational behaviour, which was not part of this project's remit.

8.3.10 IS in Construction SMEs

The research provides some key general points for any Construction SMEs with a view to implementing information system solutions, ten of which are listed in the section above. However, the one vital lesson from a construction company stance is that tendering is a way of life; use it to your advantage. SMEcon trapped themselves by failing to act on something that they are required to do as part of their standard 'modus operandi'. Due to the rare nature of this study, it is difficult to state with all authority that this kind of illogical behaviour is widespread amongst construction SMEs.

Another contribution to knowledge involves the speed of uptake of the project. This study started in 2006, but it was early 2007 before the researcher was able to work with the company. This delay was unfortunate, but did lead the researcher to question whether SMEs can adapt quickly to change, as is often described in the literature. Indeed, SMEcon knew this project was going ahead late in the summer of 2006, before the researcher himself signed up to read for a research. This, allied to the time that was taken to create the paper-based system, again initiated before this project, showed signs of inflexibility on behalf of the organisation. When the whole project is taken into consideration, three years to adopt a DMS within the company is an incredible amount of time for something described by most as so important to the operation of the company. Further research regarding resource allocation decisions and the nature of Construction SMEs may shine some light onto this phenomenon.

8.3.11 Additional example of ICT/IS adoption in SMEs

This thesis is the output of a rare project studying an ICT adoption within a small construction company. Although there are other SME, ICT adoption projects, such as the WestFocus report mentioned in Chapter 2, they tend to be across industry sectors that do not represent the construction industry. This is astonishing considering the amount of SMEs operating within the construction industry and the size of the industry itself. As a huge contributor to the UK GDP, the amount of SMEs is vast and surely a consideration for further study.

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10 Appendices

10.1 Appendix A - Project Timelines

Sep 06 - Oct 07	Nov 07	Dec 07	Jan 07	Feb 07	Mar 07	Apr 07	May 07	Jun 07	Jul 07	Aug 07	Sep 07	Oct 07	Nov 07	Dec 07	Jan 08
Project Events															
Information Structure Ideas for the 'Golden Rules' for information storage	Decision to leave SMEsup1	Decision to employ SMEsup2 Decision to employ SMEint			Policy on Back-ups of all systems and computers.	Keeping documents in Office 2003.	Structure of Intranet finalised.	SMEint's account manager announces he's leaving SMEint	New account manager at SMEint. Structure and wording of website confirmed	New 'structure' in intranet system. Phased launch of new system onto new SMEcon projects	Monitoring of launch	Decision to re-launch Intranet ASAP	Switch all document types from Office 2003 to Office 2007.	Switch all users' computer browsers due to unforeseen technical issues.	Trial of user manual	Handover of SMEcon information
Project Outcomes															
Design of the MIS structure in paper form	Change in IT support companies	Independent report on the existing systems	SMEsup2 audit SMEcon's IT systems	IT back-up issue	Work done on Version 2 of MIS paperwork	Continuation of March's work	Website redesign	Website Launch	Intranet redesign and Launch	Holiday period in SMEcon.	Major Intranet redesign	Work done on Version 3 of MIS paperwork	Continuation of October's work.	Re-launch of Intranet	Training and Handover

Sep 06 - Oct 07 | Nov 07 | Dec 07 | Jan 07 | Feb 07 | Mar 07 | Apr 07 | May 07 | Jun 07 | Jul 07 | Aug 07 | Sep 07 | Oct 07 | Nov 07 | Dec 07 | Jan 08

Action Research Cycles							
AR Cycle 1	**AR Cycle 2**	**AR Cycle 1 into Cycle 2**	**AR Cycles 2 and 3**	**AR Cycle 3**			
Study Activities							
Observation, Document analysis	Observation, Comparative analysis	Observation	Observation	Observation	Questionnaire, Observation, Comparative analysis	Comparative analysis, Observation	Observation, document analysis, theme identification
Study Topics							
Studied background of AR, IS, ICT, SMEs, Construction Companies. Began forming prescriptive adoption methods for IS	Began to investigate other, non-positivist approaches due to problem being reframed by SMEcon's actions.	Constructionism, SCOT	Technological Frames	Competencies	Other research tools investigated in order to enhance the academic explanation of SMEcon's actions, including Bricolage, Mode 2, Storytelling.		

Practical adoption lessons – when they became apparent			
3. As a Construction SME, tendering is a way of life; use it to your advantage. 4. Use as many knowledgeable people as possible to gather advice and evidence of similar projects. 5. Use the SME networks professionally, not just who you know directly or through friends.	6. Have a defined process of how your business operates day-to-day that everyone agrees to and follows. 8. Consider the ultimate goal of the project and understand that ad-hoc changes can be devastating to the aim.	1. Do not allow one staff member to wholly advise on the project; it must be a representative spread of staff members/stakeholders to represent the whole organisation. 7. As your company develops and grows, make note of the changes in how you work, who does it, and what the effects are. 2. Do not isolate your staff from the project. Their assistance will mitigate against resistance to and changes.	9. Use the project to identify and cultivate the competences within the organisation. 10. Add to the organisation's competences by utilising other peoples' backgrounds and experiences.

10.2 Appendix B – AR Cycles in action

Figure A

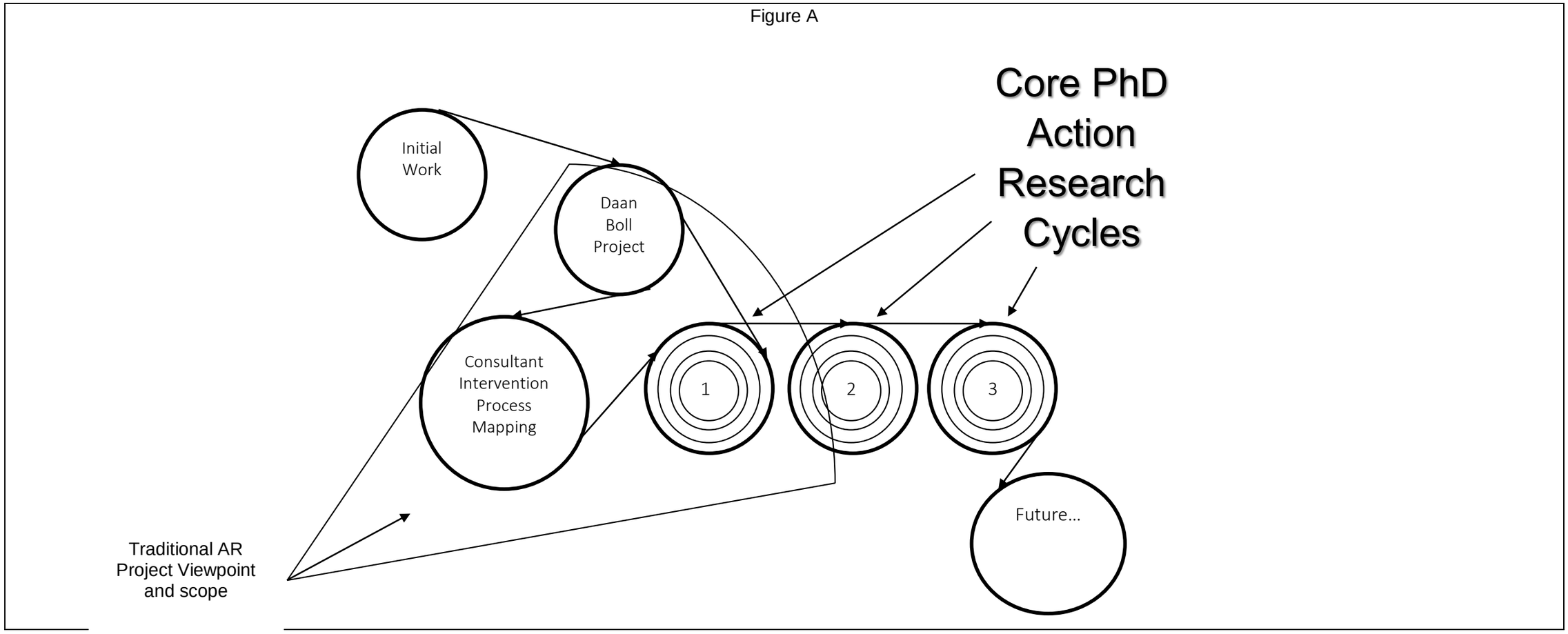
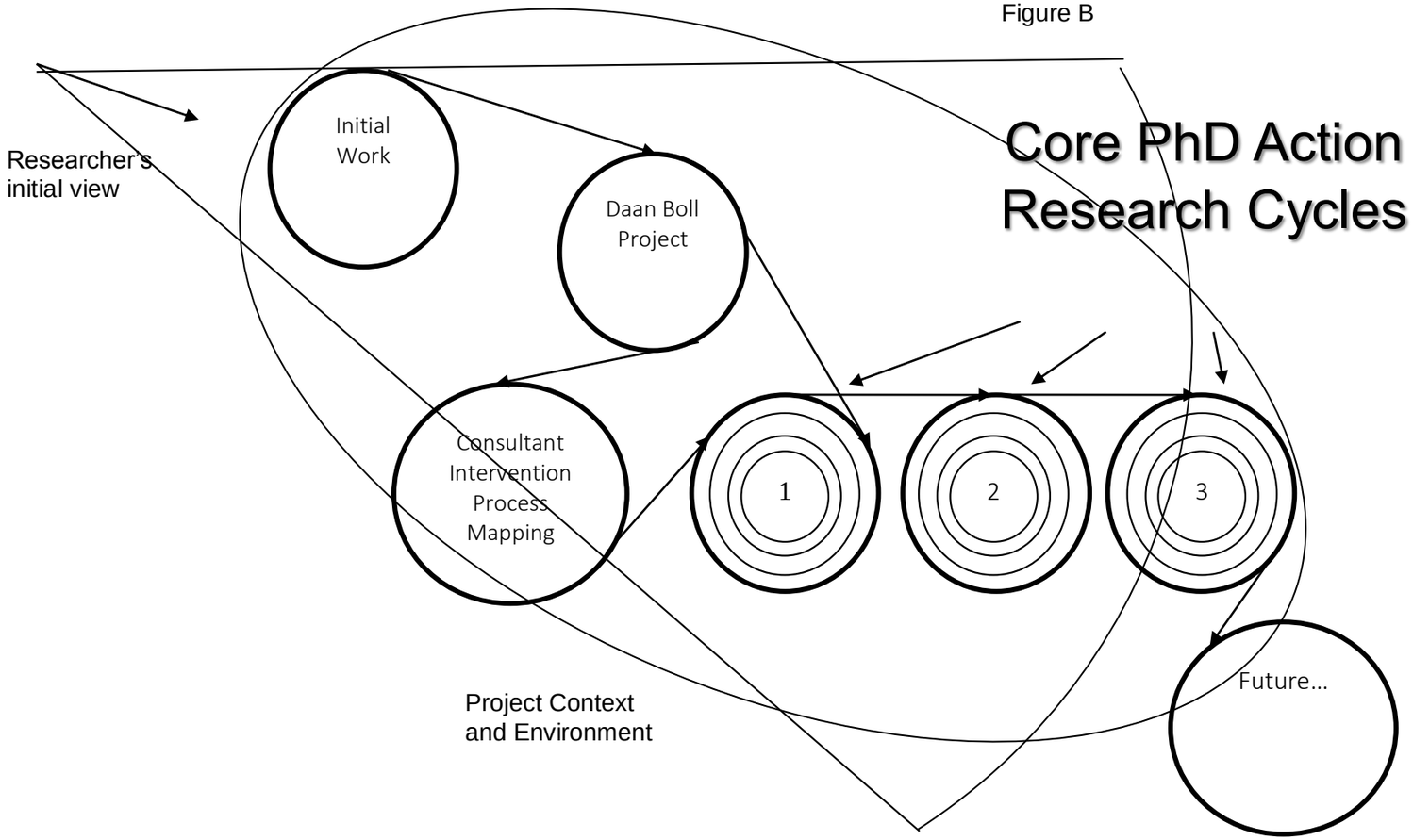


Figure B


Core PhD Action Research Cycles
Researcher's initial view
Initial Work
Daan Boll Project
Consultant Intervention Process Mapping
1
2
3
Future…
Project Context and Environment